DECLARATION
for the
RECORD OF DECISION

Moss-American Site, Milwaukee, Wisconsin

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Moss American Site, in Milwaukee County, Wisconsin, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for this Site.

The Wisconsin Department of Natural Resources concurs with the selected remedy. The information supporting this remedial action decision is contained in the administrative record for this Site.

Assessment of the Site

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The selected remedy will be the final remedy at the Site and addresses three contaminated media, on-site soil, on-site groundwater, and sediment of the Little Menomonee River. The selected remedy uses treatment to address the principal threats to human health and the environment posed by conditions at the Site. The remedy combines source removal and treatment with containment and short-term site access restrictions, thus reducing the threats significantly.

The major components of the selected remedy include the following:

- Removal and treatment of 5,200 cubic yards of contaminated sediment and 80,000 cubic yards of soil by on-site bioremediation, covering remaining soil and treatment residue for a total of 210,000 cubic yards, on-site.
- Rerouting river parallel to existing channel, filling in and covering existing channel.
- Collecting and treating contaminated groundwater.
- On-site disposal of residue from treatment of Northeast Landfill soil in RCRA compliant unit within the area of contamination.

Specifically, the river will be rechanneled; highly contaminated on-site soil and sediment from the old river channel will be excavated and treated by soil-washing and slurry bio-reactor to health based risk levels of 1×10^{-4} or less. The treatment residue and low level remaining contamination will be covered on-site; the old river channel will be covered with soil from the new channel. Extracted groundwater will be treated by oil/water separator and activated carbon.

Long-Term Management:

The selected remedy provides for continuing monitoring of the groundwater for at least 5 - 10 years after the remedial action is complete. It is anticipated that source removal will reduce groundwater contamination to acceptable limits within five years. However, ground-water quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met.

The selected remedy also provides for fencing around the landfill area, and groundwater monitoring between the old and the new river channels.

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the

remedial action and is cost-effective. A waiver is justified pursuant to Section 121(d)(4)(B) for the Subtitle C cap and for the State double-liner/leachate collection system requirement, on the basis that an impermeable cap and liner that prevents flushing of groundwater contaminants will present a greater risk to health and the environment by prolonging the groundwater treatment to greater than 200 years. The selected remedy will comply with the Land Disposal Requirements (LDRs) through a Treatability Variance for the contaminated soil and debris.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as their principal element.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus
Regional Administrator

9/27/90
Date

Betty Lewis - EPA Reg V
(SHS/11)

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny, Secretary
Box 7921
Madison, Wisconsin 53707
TELEFAX NO. 608-267-3579
TDD NO. 608-267-6897
SOLID WASTE TELEFAX NO. 608-267-2768

September 13, 1990

IN REPLY REFER TO: 4440

Mr. Valdas V. Adamkus, Administrator
U. S. EPA Region V
230 S. Dearborn St.
Chicago, Ill 60604

SUBJECT: Selected Remedy, Moss American (Kerr-McGee) Superfund Site
Milwaukee, WI

Dear Mr. Adamkus:

The Department is providing you with this letter to document our position on the proposed final remedy for the Moss American (Kerr-McGee) Site. The proposal, as identified in the May 29, 1990 Proposed Plan, includes the following:

ALTERNATIVE 3A

. Remove and treat highly contaminated sediment and soil in on site slurry bioreactor
. Reroute river
. Cover remaining contaminated sediment in place
. Collect and treat contaminated ground water
. On-site disposal of residues from treatment of Northeast Landfill soil

Time to Implement:	3 - 4 years
Capital Cost:	$25,000,000
Annual O&M Cost:	$ 130,000
Total Present Worth Cost*:	$26,000,000

* Based on 30 years of O&M

The Department concurs with the selection of this remedy as described above and in the Record of Decision for the site.

We understand that if the potentially responsible parties do not agree to fund the remedy, the State of Wisconsin will contribute 10% of the remedial action costs associated with this action and 10% of the O&M costs for the first 10

years of groundwater collection and treatment. In addition, if the potentially responsible parties do not agree to fund the O&M, the State of Wisconsin will contribute 10% of all other O&M costs for the first year and provide for all O&M after that. We provide this assurance on the assumption that U. S. EPA will pursue all actions with the PRP's prior to expending the fund at the site.

We also understand that our staff will continue to work in close consultation with your staff during the pre-design, design and construction phases of the remedy.

Thank you for your support and cooperation in addressing this contamination problem at the Moss American Site in Milwaukee. If you have any questions regarding this matter, please contact Mr. Paul Didier, Director of the Bureau Solid and Hazardous Waste Management, at (608) 266-1327.

Sincerely,

C. D. Besadny, Secretary

CDB:GAE

cc: Lyman Wible - AD/5
Linda Meyer - LC/5
Paul Didier - SW/3
Frank Schultz - SED
Jim Schmidt - SED
Betty Lavis - U. S. EPA Region V, 5HS/11
Mark Giesfeldt/Sue Bangert/Gary Edelstein - SW/3

RECORD OF DECISION

ROD SUMMARY
Moss-American Site
Milwaukee, Wisconsin

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1. Site Description

The eighty-eight acre **Moss-American Site** includes the former location of the Moss-American creosoting facility, five miles of the Little Menomonee River, a portion of which flows through the eastern half of the site, and the adjacent flood plain soils. The Site is located in the northwestern section of the City of Milwaukee, County of Milwaukee, State of Wisconsin, at the southeast corner of the intersection of Brown Deer and Granville roads, at 8716 Granville Road. See Figure 1 for a location map of the Site. Sixty-five acres of the Site are undeveloped Milwaukee County park land. Twenty-three acres are owned by the Chicago and Northwestern Railroad and used as an automobile loading and storage area. Figure 2 shows current Site use.

The Little Menomonee River, portions of which are defined as part of the Site, flows through the northeastern portion of the Site, continuing on through the Milwaukee County Parkway, to the confluence of the Menomonee River about five miles to the south. The Little Menomonee River is included in the Milwaukee Estuary and the Menomonee River Remedial Action Plans (RAP) by virtue of its inclusion in the Menomonee River watershed. The river is classified INT-D, which means that it is considered suitable for intermediate (tolerant) fish and aquatic life. The Site is located in a moderately populated suburban area of mixed industrial, commercial, residential, and recreational use. South Eastern Wisconsin Regional Planning Commission (SEWRPC) estimates the population at 2,036 persons per square mile. The nature of current Site and area uses is not expected to change in the near future.

The Milwaukee County Soil Survey classifies the developed areas on the Site west of the river as loamy land, land consisting of fill or cut and borrow areas. The wooded areas on both sides of the river consist of a poorly drained silty soil underlain by stratified lacustrine silt and very fine sand. The soil is moderately permeable with high available water capacity. Approximately one-quarter of the Site is in the 100-year flood plain as shown in Figure 3.

The Site overlies a surficial, low yield, Class II aquifer above a confining bed of dense silty clay till. The confining bed is a minimum of 40 feet thick and could be as thick as 120 feet. Below the confining bed lies the regional dolomite aquifer. The saturated thickness above the till is between 5 and 15 feet. Groundwater flows at a rate of seven feet per year from west to east, discharging into the river at an average rate of 8,500 gallons per day. Depth to groundwater varies from zero feet in the wetlands near the river, to about 12 feet further west on the Site. The groundwater is not currently used as a source of drinking water; local residents are connected to a municipal system.

Elevations at the Site range from 714 to 750 feet. The river

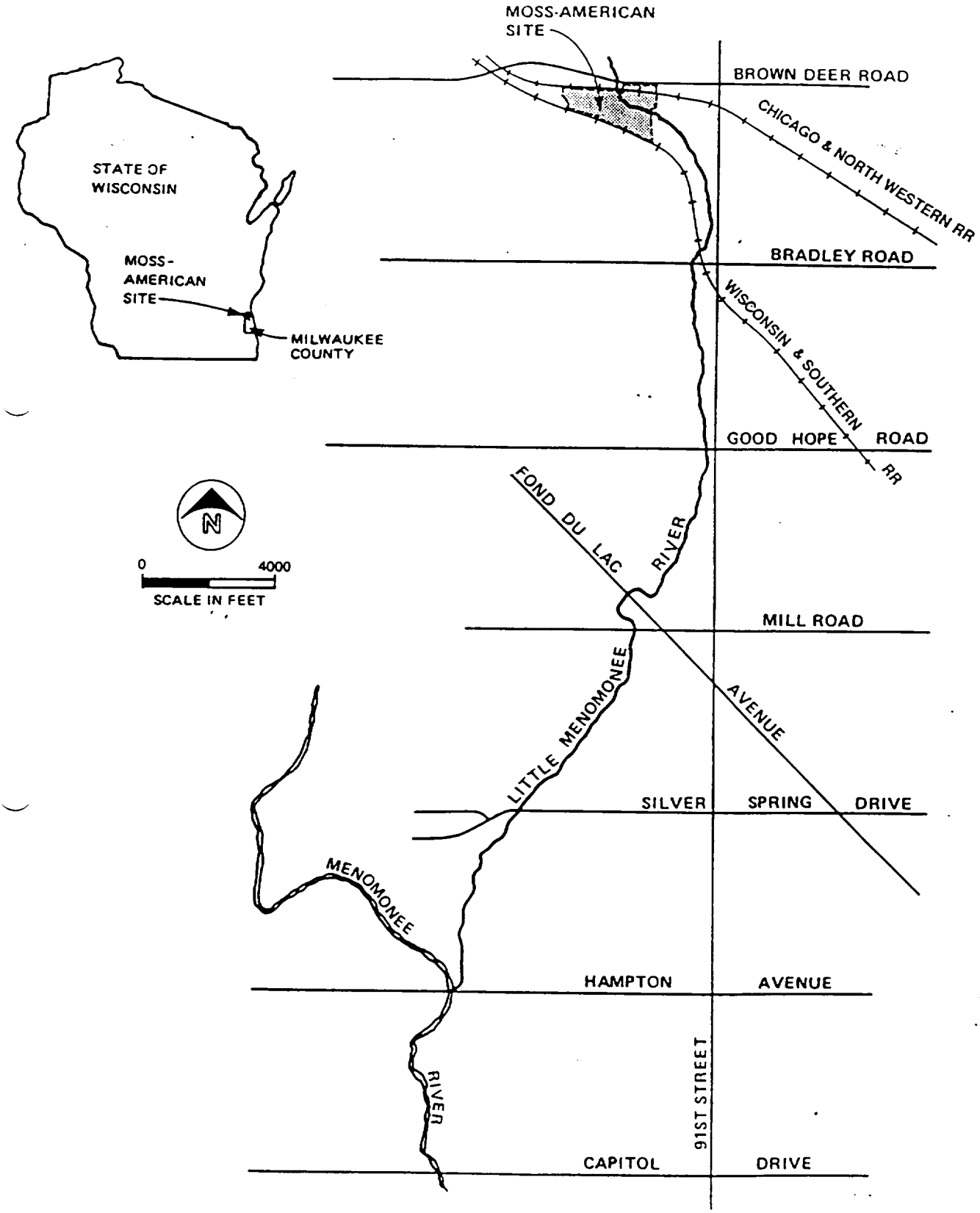


FIGURE 1
LOCATION MAP
MOSS-AMERICAN FS

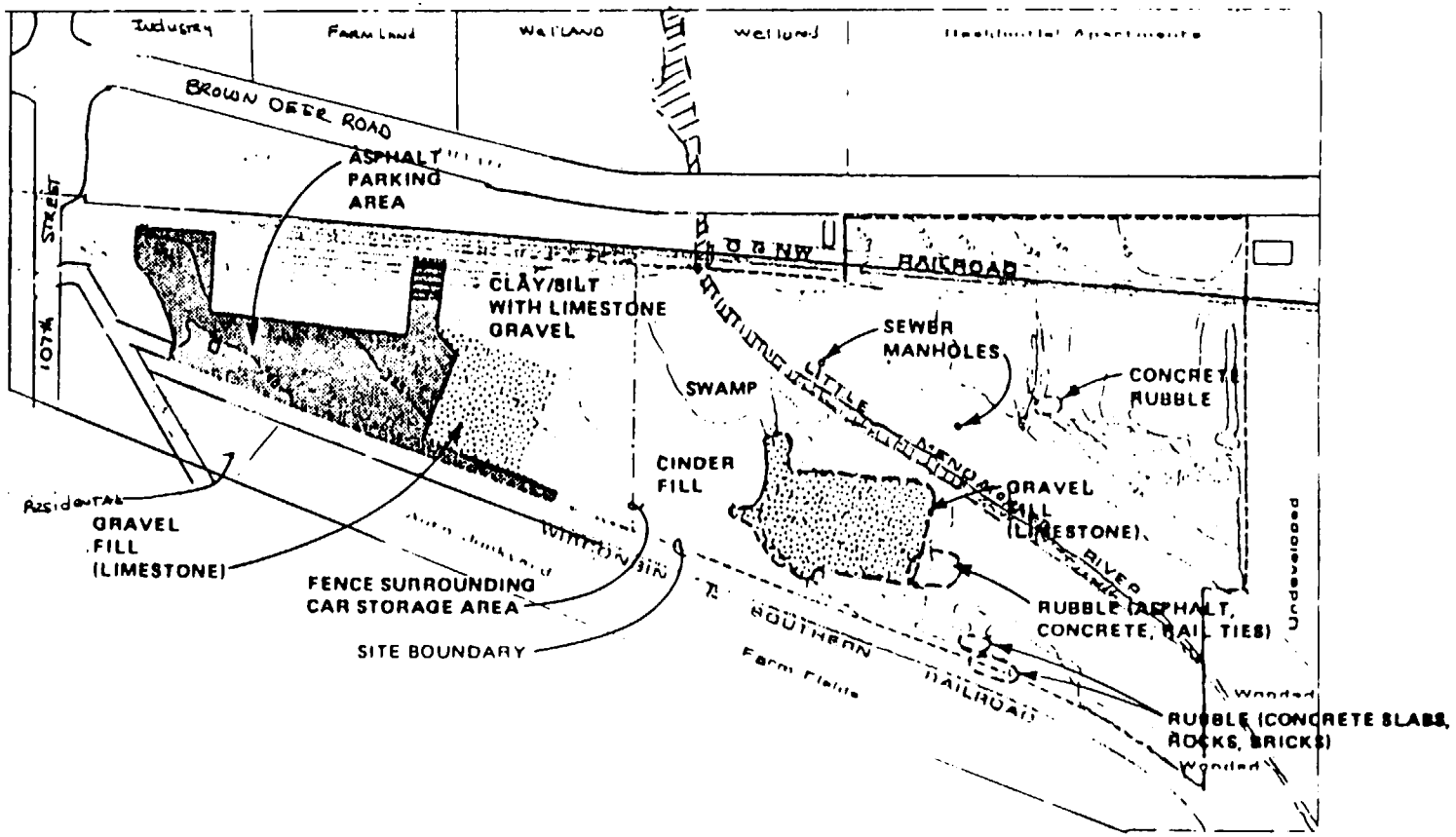


FIGURE 2
EXISTING CONDITIONS: 1987
MOSS-AMERICAN FS

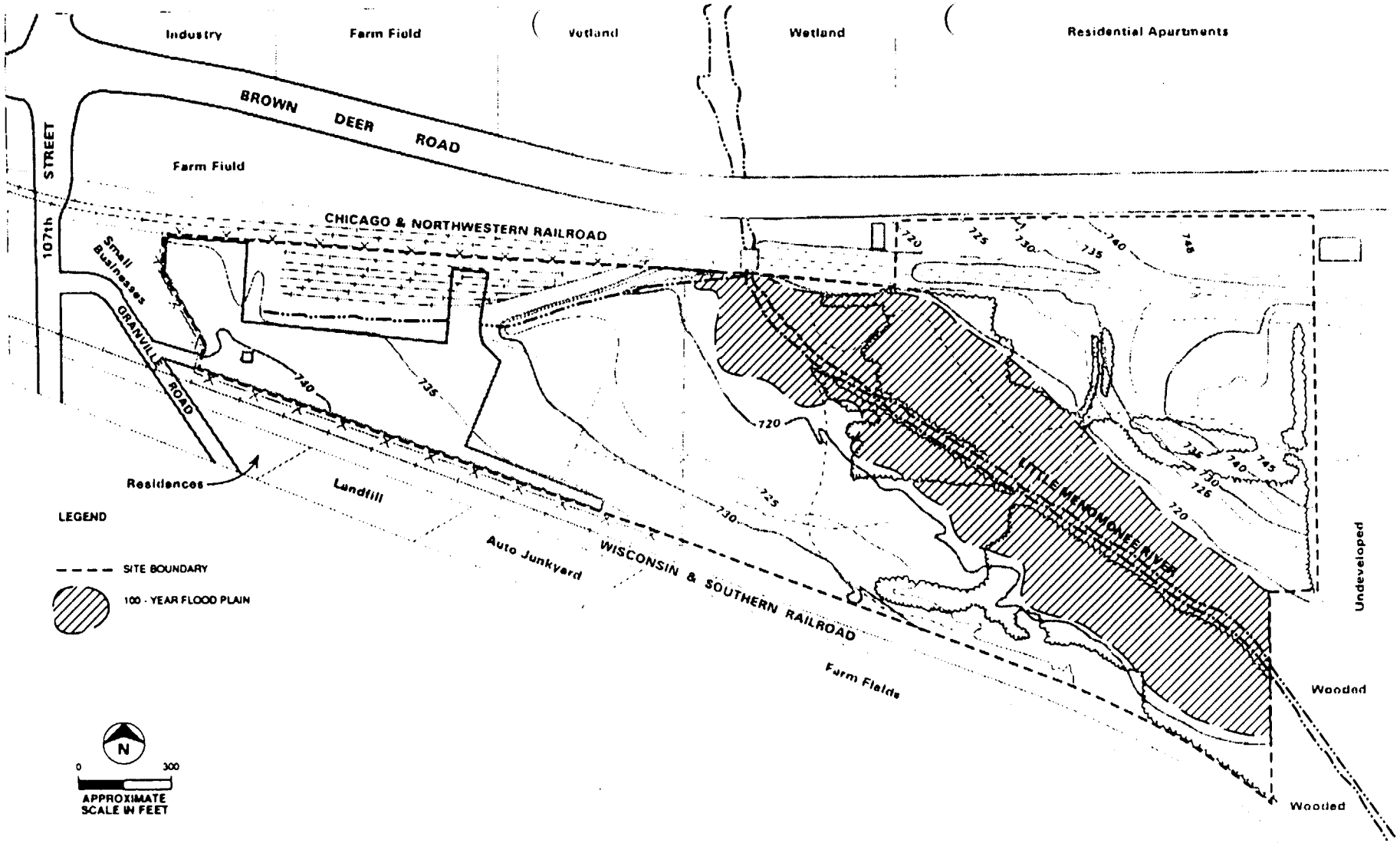


FIGURE 3
100 - YEAR FLOOD PLAIN
MOSS-AMERICAN FS

CL 085564 FS 100 YR FLOOD PLAIN 3-27-80

drains the entire Site, running adjacent to the facility for about 2,100 feet. Typical base flow water depth of the Little Menomonee River is 1 to 2 feet, with a corresponding width of about 20 feet. Flow rate is estimated at an average annual of 10 - 17 cubic feet per second, with a peak rate of 330 - 770 cubic feet per second. The sediment is typically silt or clay in composition, soft in some areas and hard packed in others.

2. Site History and Enforcement Activities

In 1921, the T. J. Moss Tie Company established a wood preserving facility on twenty-three acres of the Site west of the Little Menomonee River. The plant preserved railroad ties, poles, and fence posts with creosote, a mixture of 200 or more chemical compounds derived from coal tar and fuel oil. The process used a 50/50 mixture of creosote and No. 6 fuel oil. There is no indication that any other chemicals were used at the facility. Kerr-McGee purchased the facility in 1963 and changed the facility's name to Moss-American. The name was changed again in 1974 to Kerr-McGee Chemical Corporation--Forest Products Division.

From 1921 to 1971, the facility discharged wastes to settling ponds that ultimately discharged to the Little Menomonee River. These discharges ceased in 1971 when, in response to a City of Milwaukee order, Moss-American diverted its process water discharge to the Milwaukee sanitary sewerage system. The facility closed in 1976. The eastern part of the property was acquired by Milwaukee County in 1978; Chicago and North Western Railroad bought the western parcel in 1980. Figure 4 shows historical Site uses.

State and national attention came to the Site in 1971 when young people, engaged in an Earth Day clean up of the river, received chemical burns from a tarry substance while wading more than three miles down river from the Site. Sampling results indicated that the tarry substance was creosote and that the Moss-American facility was the source of the contamination.

Subsequently, under a Wisconsin Department of Natural Resources (WDNR) order, Kerr-McGee cleaned the eight settling ponds and dredged about 1,700 feet of river to remove creosote-contaminated soil and sediment. The settling ponds were filled with clean soil, the discharge pipe to the Little Menomonee River was removed and a twelve foot deep underground clay retaining wall constructed between the ponds and the river, adjacent to the facility.

In 1973, United States Environmental Protection Agency (U. S. EPA) financed the dredging of approximately 5,000 feet of river between the Site and Bradley Road. As Figure 4 shows, most of the dredged sediment were contained on Site in the Northeast

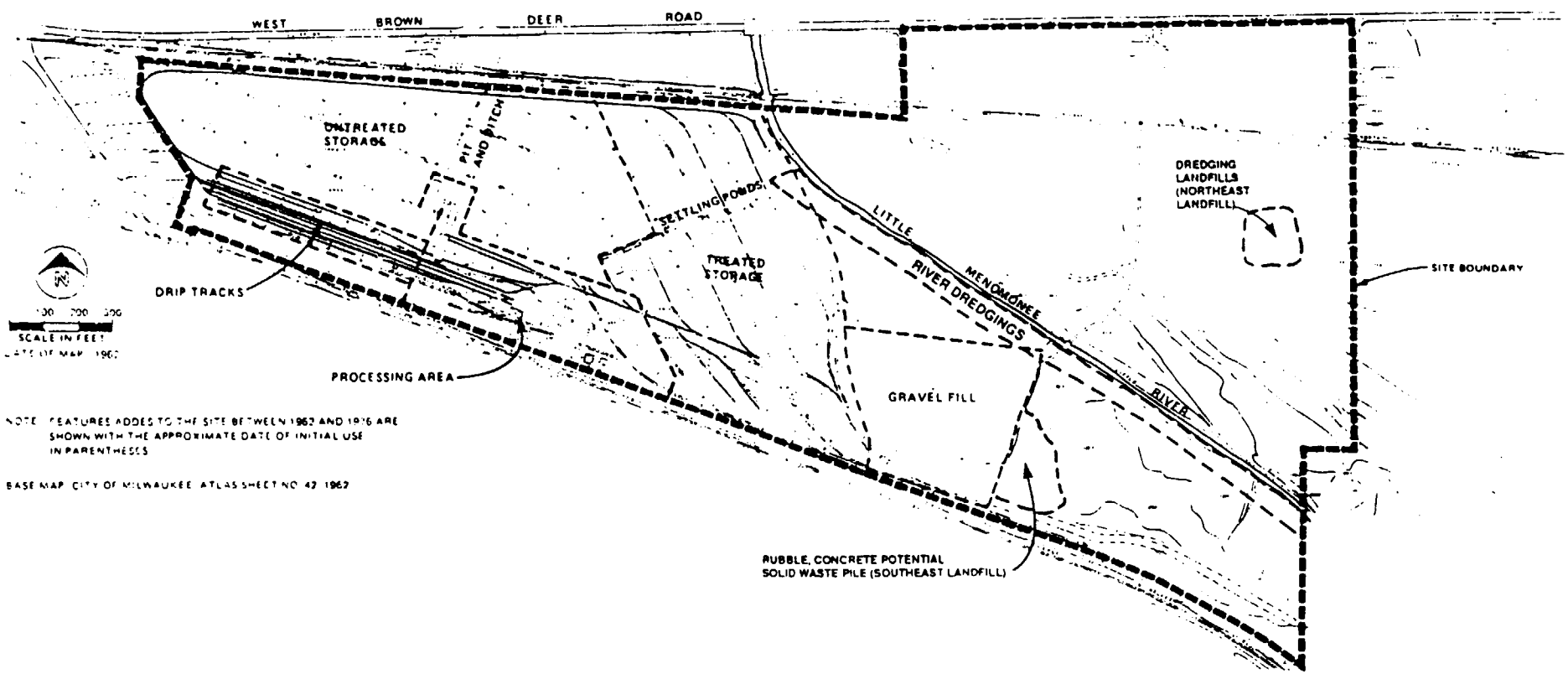


FIGURE 4
HISTORICAL LAND USE
MOSS-AMERICAN FS

Landfill area and along the west bank of the river.

In 1974, U. S. EPA (under the Clean Water Act) and Milwaukee County filed a complaint seeking an injunction against Kerr-McGee Chemical Corporation, and to recover costs incurred for studies and cleanup. In 1978, the lawsuit was dismissed due to the discovery that some of the data had been falsified. Milwaukee County reached a settlement with Kerr-McGee in which it received a major portion of the property. This property was added to the existing county park corridor along the Little Menomonee River south of the Site.

Between 1977 and 1978, the Southeast District of the Wisconsin Department of Natural Resources (WDNR) regulated the disposal of demolition waste from the facility as it was dismantled by the company. This resulted in the removal and off-Site disposal of 450 cubic yards of creosote-contaminated soil.

The water quality and soil/sediment contamination studies done by U.S. EPA and other agencies between 1970 and 1980 indicated that gross creosote contamination was present in the soil and groundwater at the facility as well as in the sediment of the Little Menomonee River. In 1983, the facility was placed on the National Priorities List (NPL) pursuant to Section 105 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. Section 9605 with a Hazard Ranking Score (HRS) of 32.14.

In April of 1985, notice letters were mailed to the potentially responsible parties (PRPs) which included Kerr-McGee, Chicago and Northwestern Railroad, and Milwaukee County, inviting them to negotiate for the conduct of the Remedial Investigation/Feasibility Study (RI/FS) at the Moss-American Site. All three PRPs attended the meeting held 8/22/85 but declined to undertake the RI/FS. Under an existing remedial contract, U. S. EPA assigned the consulting firm of CH2M Hill the RI/FS project, which began in 1987. The RI report was completed in December 1989 and the FS approved in May 1990.

3. Highlights of Community Participation

In October 1987 U.S. EPA hosted a "kickoff" availability session at Vincent High School in Milwaukee. This informal session was designed to talk with people in a one-on-one situation about the pending start of the RI/FS. A community relations plan was finalized in November 1986. Fact sheets were developed for and distributed to the community in October 1987, Spring 1988, and May 1990.

The RI Report was released to the public in December 1989. The public was informed through a Fact Sheet that summarized the findings of the RI and invited comments. No comments were

received. The FS Report and the Proposed Plan for the Moss-American site were released to the public for comment on June 4, 1990. These two documents were made available to the public in both the administrative record and an information repository maintained at the U. S. EPA Docket Room in Region V and at the Mill Road Library, located at 6431 North 76th Street, Milwaukee, Wisconsin. The notice of availability for these two documents was published in the Milwaukee Journal on May 25, 1990. A public comment period on the documents was held from June 4, 1990 to July 5, 1990 and extended to August 6, 1990.

In addition, a public meeting was held at Vincent High School on June 21, 1990. Twenty nine people attended the meeting. Those in attendance were members of the media, representatives from Kerr McGee, Chicago and Northwestern Railroad and Milwaukee County, the potentially responsible parties (PRPs), vendors of various remedial technologies, State Representative Tom Barrett, and eight to ten residents of the area. At this meeting, representatives from U.S. EPA, Wisconsin Department of Natural Resources (WDNR), and the Department of Health answered questions about the Site and the remedial alternatives under consideration. A response to the comments received during this comment period is included in the Responsiveness Summary, which is part of this ROD.

The public participation requirements of CERCLA sections 113 (k) (2) (B) (i-v) have been met in the remedy selection process. This decision document presents the selected remedial action for the Moss-American Site, in Milwaukee, Wisconsin, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan (NCP). The decision for this Site is based on the administrative record.

4. Scope and Role of Response Action

As with many Superfund sites, the problems at the Moss-American Site are complex. Remediation at the Site addresses three contaminated media, on-site soil, on-site groundwater, and sediment of the Little Menomonee River. A possible fourth contaminated media, the downstream portion of the flood plain not included in the soil remedial action, will be investigated further in the predesign phase. If sampling indicates that contamination is present above risk levels, it will be addressed as part of this response action. This response action will be the final remedy at the Site.

This remedial action addresses the principal threats to human health and the environment posed by conditions at the Site. The threats to human health and the environment come from direct or indirect exposure to Site contaminants in on-site soil or sediment, by direct contact, inhalation, or ingestion. Groundwater, while presently not a source of drinking water, is a

continuing source of contamination to the river. The remedy combines source removal and treatment with containment and short-term Site access restrictions, thus reducing the threats significantly.

Specifically, the river will be rechanneled; highly contaminated on-site soil and sediment from the old river channel will be excavated and treated by soil-washing and slurry bio-reactor to health based risk levels of 1×10^{-4} or less. The treatment residue and low level remaining contamination are covered on-site; the old river channel is covered with soil from the new channel. Extracted groundwater will be treated by oil/water separator and activated carbon.

The selected remedy provides for continuing monitoring of the groundwater for 5 - 10 years after the remedial action is complete. It is anticipated that source removal will reduce groundwater contamination to acceptable limits within five years. However, ground-water quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met. Target compounds for groundwater are the B-E-T-X compounds: benzene, ethylbenzene, toluene, and xylene. The groundwater cleanup standards are the preventative action limits (PALs) for B-E-T-X compounds established by the State of Wisconsin and described in Section 7.

5. Summary of Site Characteristics

The RI confirmed that polyaromatic hydrocarbons (PAHs), components of creosote, are the major contaminants at the Site. Creosote is a coal tar distillate containing over 200 different compounds, but predominantly composed of PAHs, multi-ringed organic chemicals. These contaminants contain a Resource Conservation and Recovery Act (RCRA) listed waste, K001 and U051. Figure 5 shows the extent of soil and groundwater contamination.

5.1 On-site Soil

The RI determined that, while low levels of contamination are found throughout the on-site soil on the west side of the river, most of the contamination is focused in the former use areas: the processing area and vicinity, the settling ponds, the treated storage areas, the southeast landfill, and the northeast landfill, an isolated area on the east side of the river. PAH levels as high as 3.2% were found in these areas, and, in addition, free product was observed in some test pits. Benzene-Toluene-Xylene (BTX) levels range from .02 to 17 ppm. Contamination is greatest in the upper 10 feet of soil but may extend down as far as 20 feet. Additional sampling will be necessary during predesign to further define both extent and depth of contamination.

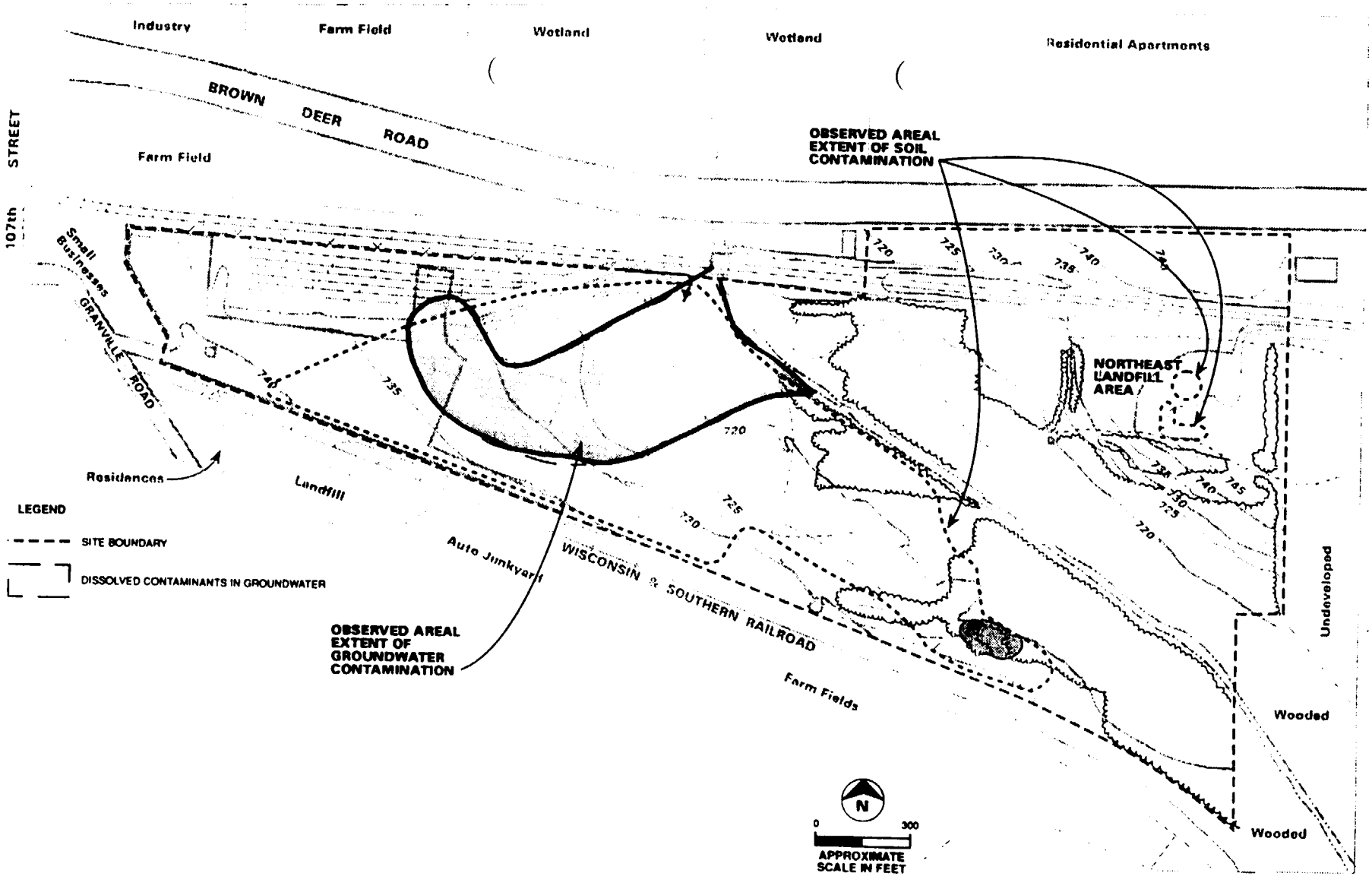


FIGURE 5
EXTENT OF SOIL AND GROUNDWATER CONTAMINATION
MOSS-AMERICAN FS

5.2 Groundwater

The nature and extent of groundwater contamination was defined at the Site through the placement of shallow, intermediate and deep wells. Contaminants were detected only in the shallow wells, no contaminants were detected deeper than 20 feet. Contaminants found in the groundwater are polyaromatic hydrocarbons (PAHs) and BTXs. Free product was found in two monitoring wells near the settling pond area; CPAH concentration in the oil phase of the sample was almost 12%. Additional deep monitoring wells will be placed during design to monitor the quality of the regional aquifer. The contaminated plume is approximately 600 feet across, extending about 100 feet from the pit and ditch area east to the Little Menomonee River. Groundwater flow is from west to east, into the Little Menomonee River, at a rate of 3,000 to 14,000 gallons per day.

5.3 Surface water of the Little Menomonee River

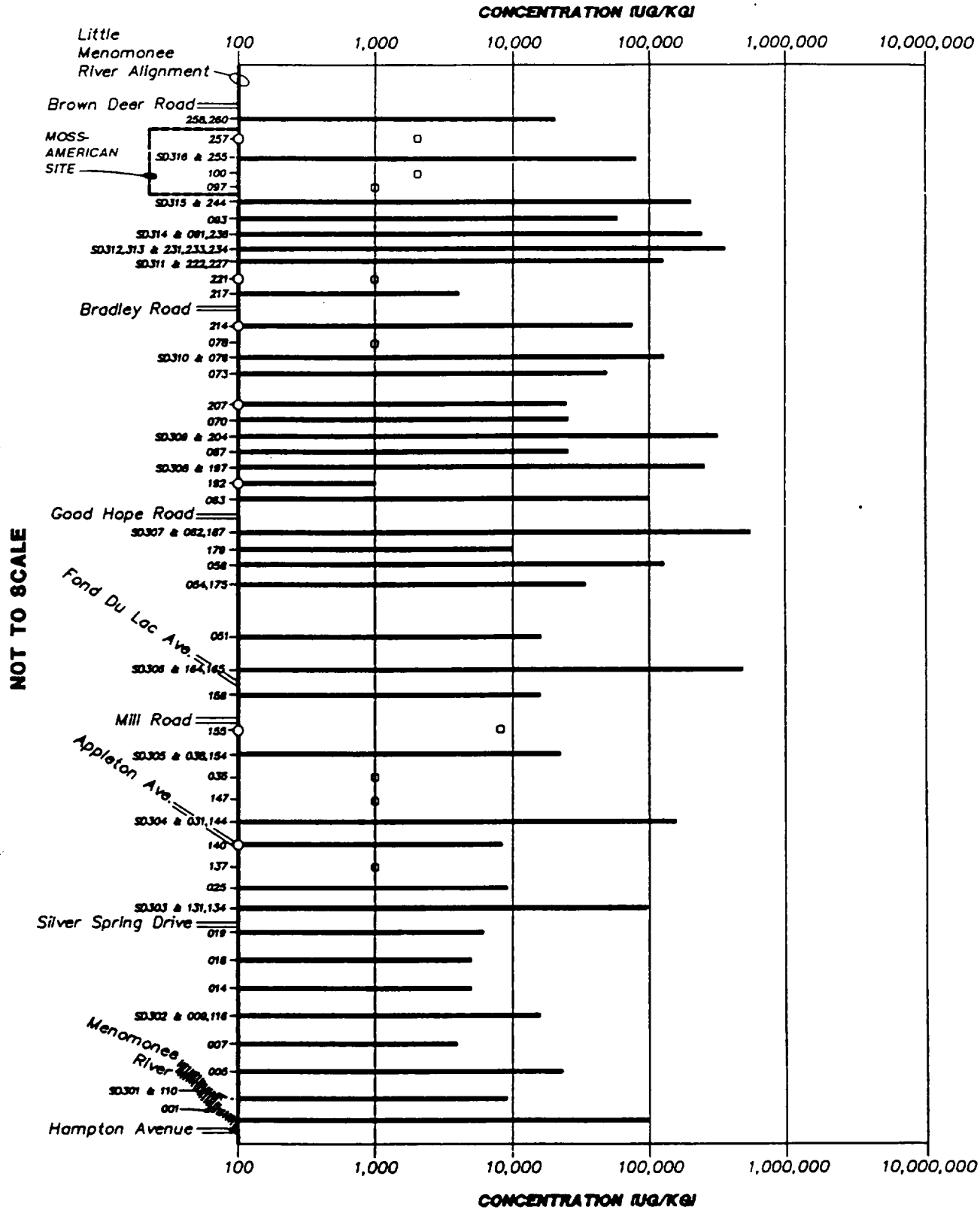
The surface water of the Little Menomonee River does not appear to be contaminated. No PAH or volatile organic compound (VOC) values exceeding background were detected. No visible evidence of surface water contamination was noted during the sampling. Oil sheens have been observed when sediments are disturbed, however. This is to be expected, since most PAHs have low solubility in water and would normally sink to the river bottom. VOCs would volatilize.

5.4 Sediment of the Little Menomonee River

Contaminants detected in the sediment were similar to those detected in the soil, with PAHs being the primary contaminants of concern. Sediment contamination exceeding background (currently estimated at 18 ppm CPAHs) was found fairly evenly distributed throughout the five mile reach of the river between the Site and its confluence with the Menomonee river. Refer to the FS, Appendix J, for the sediment background sampling method and the data obtained. PAH levels in the sediment were as high as 5900 ppm and CPAH levels as high as 500 ppm. Figure 6 compares the sediment CPAH levels in each segment of the Little Menomonee River.

6. Summary of Site Risks

As part of the RI, a baseline risk assessment was conducted for the Moss-American Site. A baseline risk assessment evaluates actual and potential threats to human health and the environment posed by a site in the absence of any remedial action. It identifies and characterizes the toxicity of contaminants of potential concern, potential exposure pathways, potential human and environmental receptors, and the extent of expected impact or threat under the conditions defined for the site.



LEGEND

SEDIMENT SAMPLE NO. AND LOCATION (If more than one sample was taken at a sample location, concentration is the highest of the two.

257 INLET SAMPLE NO. AND LOCATION

□ NOT DETECTED AT DETECTION LIMIT INDICATED

FIGURE 6
SUM OF CARCINOGENIC PAHs IN SEDIMENTS
MOSS-AMERICAN FS

The chemicals of concern at the Site, those the Risk Assessment is based upon, are eight CPAHs. The CPAHs of concern at the Site are:

benzo[a]anthracene	chrysene
benzo[b]fluoranthene	benzo[k]fluoranthene
benzo[a]pyrene	indeno[1,2,3-cd]pyrene
dibenzo[a,h]anthracene	benzo[g,h,i]perylene

6.1 Exposure Assessment

The Risk Assessment determined that exposure to the chemicals of concern and other Site-related contaminants in soil and sediment can occur through three exposure pathways: direct contact, direct or indirect ingestion, and inhalation of suspended particles. Exposure scenarios were developed to describe potential human exposures, via these pathways, under current Site conditions and future potential Site uses. Potential effects on the environment were also evaluated.

The Risk Assessment concluded that actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.2 Contaminant Identification

Seventy chemicals on the U.S. EPA's Target Compound List (TCL) were detected at the Moss-American Site. From the 70 chemicals detected, a subset were identified as contaminants of potential concern for use in the baseline risk assessment. Table 1 lists contaminants of potential concern. Chemicals were selected primarily on the basis of having available toxicity values (i.e., cancer potency factors and reference dose values) and environmental media standards and criteria. Additional chemicals were included based on factors including toxicity, frequency of detection, concentration, and environmental fate.

6.3 Toxicity Assessment

The toxicity assessment addressed both the potential human health and environmental effects associated with the chemicals of potential concern.

Carcinogenic Risk: Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound

Table 1 (Page 1 of 2)
Potential Contaminants of Concern and Criteria for Selection
Moss-American Site

CHEMICAL	Selected based on critical toxicity values	Selected based on toxicity concerns	Selected based on other factors
Acenaphthene			d
Acenaphthylene			d
Acetone	a		
Anthracene			d
Antimony	a		
Arsenic	b		
[illegible]rium	a		
[illegible]enzene	b	c	
Benzo[a]anthracene		c	
Benzo[b]fluoranthene		c	
Benzo[k]fluoranthene		c	
Benzo[g,h,i]perylene			
Benzo[a]pyrene	a		
Benzoic Acid	a		
Beryllium	a		
bis(2-Ethylexyl)phthalate	a/b		
2-Butanone	a		
Cadmium	a/b		
Chlorinated dioxins and furans			f
Chloroform	a/b		
Chromium	a/b		
Chrysene			d
Copper	a		
[illegible]eosote	b		e
[illegible]benz[a,h]anthracene		c	
Dibenzofuran			d
1,1-Dichloroethane	a/b		
2,4-Dinitrophenol	a		
Ethylbenzene	a		
Fluoranthene			d
Fluorene			d
Indeno[1,2,3-cd]pyrene		c	
Lead	a		
Manganese	a		
Mercury	a		
Methylene chloride	a/b		
Naphthalene	a		
Nickel	a		
Phenanthrene			d
Phenol	a		
Pyrene			d

Table 1 (Page 2 of 2)
Potential Contaminants of Concern and Criteria for Selection
Moss-American Site

CHEMICAL	Selected based on critical toxicity values	Selected based on toxicity concerns	Selected based on other factors
Styrene	a		
2,3,7,8-TCDD	b		
Toluene	a		
1,1-Trichloroethane	a		
Vanadium	a		
Xylenes	a		
Zinc	a		

a. Selected based on having a reference dose value.
b. Selected based on having a cancer potency value.
c. PAHs selected based on potential carcinogenicity.
d. Selected based on frequency of occurrence and relative abundance.
e. Creosote selected because it is the major source material.
f. Dioxins and furans selected based on toxicity.

estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Noncarcinogenic Risk: Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

6.4 Human Health Effects

The main health effects associated with the major chemical groups found at the Site are:

- Creosote--exposure to creosote liquid or vapor may produce skin irritation and ulceration, increased salivation, vomiting, and respiratory difficulties. Some of the PAH components are known to be carcinogenic.

- Polyaromatic hydrocarbons--PAHs, a primary component of creosote, have been associated with lung, stomach, and skin cancers. Carcinogenicity has been associated with the 4- and 5-ring PAHs such as benzo[a]pyrene. Some noncarcinogenic PAHs appear to enhance the carcinogenic potential of the carcinogenic PAHs.

- BTX Compounds--Benzene is a human and animal carcinogen associated with leukemia. Toluene and xylene cause depression of the central nervous system.

- Phenolic Compounds--Phenolic compounds are corrosive to skin and cause severe systemic poisoning.

- Inorganic Chemicals--Arsenic is a known human skin and lung carcinogen. Cadmium is associated with respiratory and kidney toxicity as well as prostate and lung cancer. Lead is toxic to the nervous system, blood, and cardiovascular

system. Zinc is associated with fever, nausea, and stomach disturbances.

Twenty of the contaminants detected at the Site are classified as known (class A), probable (class B1 and B2), or possible (class C) human carcinogens by the U.S. EPA Carcinogen Assessment Group (Table 1-a).

6.5 Environmental Effects

Exposure of birds, terrestrial wildlife, and aquatic plants and animals can occur through direct contact, or ingestion of contaminated surface soil or contaminated sediment of the Little Menomonee River. PAHs were the primary focus of the environmental effects evaluation because of their abundance in the soil and sediment at the Moss-American Site. In general, the information based on the environmental effects of PAHs is not very extensive. There are no promulgated standards or criteria for PAHs designed for the protection of aquatic organisms or terrestrial wildlife.

However, PAHs that are carcinogenic to mammals are generally also carcinogenic to fish. In many cases, aquatic organisms from PAH-contaminated environments have a higher incidence of tumors and hyperplastic disease than those from nonpolluted environments. A growing body of evidence, mostly circumstantial, links PAHs to cancer in fish populations, especially bottom dwelling fish from areas with sediment heavily contaminated with PAHs. The State of Wisconsin has developed Sediment Quality Criteria (SQC) for the Little Menomonee River based on the equilibrium partitioning approach. The SQC, shown in Table 4, set a level of 3 ppm for CPAHs in sediment. This equates to a human health risk of approximately 1×10^{-6}.

Data are unavailable on acute and chronic toxicity for avian wildlife, reptiles, or amphibians. Numerous PAH compounds are distinct in their ability to produce tumors in the skin and most epithelial tissues of animal test species. These effects are likely a concern for mammalian wildlife exposed to PAHs.

6.6 Public Health Risk Characterization

This section summarizes the results of the risk characterization. It includes the quantified carcinogenic risks for each contaminant of concern in each exposure medium for each exposure pathway; the combined carcinogenic risks reflecting all contaminants and pathways reasonably expected to affect a given population; and the potential for noncarcinogenic effects as identified by the hazard quotient for each contaminant of concern in each exposure medium for each exposure pathway.

Table 1-a
POTENTIAL CARCINOGENS

U.S. EPA Carcinogen Assessment Group Classification (a)		
CHEMICAL	Ingestion	Inhalation
Arsenic	A	A
Benzene	A	A
Benzo[a]anthracene	B2	B2
Benzo[b]fluoranthene	B2	B2
Benzo[k]fluoranthene	B2	B2
Benzo[a]pyrene	B2	B2
Beryllium	D	B2
bis(2-Ethyhexyl)phthalate	B2	D
Cadmium	D	B1
Chloroform	B2	D
Chromium (hexavalent)	D	A
Chrysene	B2	B2
Creosote	B1	B1
1,1-Dichloroethane	C	D
Indeno[1,2,3-cd]pyrene	C	D
Methylene Chloride	B2	B2
Nickel	D	A
N-Nitrosodiphenylamine	B2	D
Tetrachloroethene	B2	B2

(a) U.S. EPA Carcinogen Assessment Group Classification (IRIS database 2-1-1988)

- A: Human carcinogen - Sufficient evidence from epidemiological studies.
- B1: Probable human carcinogen - Limited evidence of carcinogenicity to humans.
- B2: Probable human carcinogen - Sufficient evidence in animals and inadequate or no human evidence.
- C: Possible human carcinogen - Limited evidence in animals and the absence of human data.
- D: Not Classified - Inadequate or no evidence to classify.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1 x 10^{-6} or 1E-6). An excess lifetime cancer risk of 1 x 10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a Site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Based on the exposure assessment, three exposure scenarios were defined to describe potential human exposures for current Site conditions and potential future uses. The exposure scenarios used to evaluate the health risks from the Moss-American Site were:

- Current conditions--site trespass scenario
- Current conditions--river recreational use scenario
- Potential future use--residential development scenario

The exposure assumptions associated with each of these scenarios are detailed in Table 1-b. For each scenario two sets of risk estimates were made. One evaluated risks based on the highest detected concentrations, and the other estimated risks based on geometric mean concentrations. For evaluation purposes, the Site was divided into areas either east or west of the Little Menomonee River.

1. Current conditions--site trespass scenario, soil

The risks associated with Site trespass are summarized in Table 1-c. Excess lifetime carcinogenic risks from soil ingestion for the eastern portion of the Site range from 3 x 10^{-4} (based on the highest detected concentrations) to 5 x 10^{-6} (based on mean concentrations). Excess lifetime carcinogenic risks from soil ingestion for the western portion of the Site range from 5 x 10^{-4} (based on the highest detected concentrations to 2 x 10^{-5} (based on mean concentrations). The CPAHs are the major chemicals contributing to the risks.

Inhalation exposures for both portions of the Site have risks less than 1 x 10-7. A comparison of estimated intakes to RfDs indicated that no RfDs were exceeded in any situation evaluated.

Table 1-b
EXPOSURE ASSUMPTIONS
MOSS-AMERICAN SITE

Target Receptor	Route	Intake Rate	Body Weight	Frequency
Trespass Setting				
Child	Ingestion	0.1 g/day	35-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	0.1 g/day	70-kg	40 days/yr 10 yrs
Child	Inhalation	13 l/min	35-kg	-
Adult	Inhalation	20 l/min	70-kg	-
Individual used for lifetime cancer risk estimate	Inhalation	20 l/min	70-kg	2 hr/day 40 days/yr 10 yrs
Residential Setting				
Toddler	Ingestion	0.2 g/day	15-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	Age 1-5: 0.2 g/day Age 6-70: 0.1 g/day	70-kg	365 days/y 70 yrs
Recreational Setting				
Child	Ingestion	0.1 g/day	35-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	0.1 g/day	70-kg	40 days/yr 10 yrs

Summary of Onsite Trespass Risks
Moss-American Site

Exposure Setting	Concentration	Target Population	Noncarcinogenic Risks			Carcinogenic Risks – Ingestion		Carcinogenic Risks – Inhalation	
			Ingestion Hazard Index	Inhalation Hazard Index	Chemicals Exceeding RfD	Total Ingestion Excess Lifetime Cancer Risk	Major Chemicals	Total Inhalation Excess Lifetime Cancer Risk	Major Chemicals
East	Highest Detected	Child	0.15	0.14	None	-	-	-	-
	Geometric Mean	Child	0.11	0.014	None	-	-	-	-
	Highest Detected	Adult	0.073	0.012	None	3E-04	PAHs(a)	2E-06	PAHs(a)
	Geometric Mean	Adult	0.055	0.011	None	5E-06	PAHs(a)	4E-08	PAHs(a)
West	Highest Detected	Child	2.4	0.023	None	-	-	-	-
	Geometric Mean	Child	0.24	0.008	None	-	-	-	-
	Highest Detected	Adult	1.2 b	0.018	None	5E-04	PAHs(a)	3E-06	PAHs(a)
	Geometric Mean	Adult	0.12	0.006	None	2E-05	PAHs(a)	1E-07	PAHs(a)

Exposure Assumptions:
Noncarcinogenic Risks - 35 kg body weight (child), 70 kg body weight (adult), 0.1 g/day soil intake
child inhalation rate 13 l/min, adult inhalation rate 20 l/min.
Carcinogenic Risks - 70 kg body weight, 0.1 g/day soil intake, 2-day/wk, 20-wks/yr, 10 years

a PAHs include benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene

b No individual chemical intake exceeds RfD. When hazard indexes are re-estimated by health effect, no subindexes exceed 1.

2. Potential future conditions--residential development, soil

The risks associated with Residential Development are summarized in Table 1-d. Excess lifetime carcinogenic risks from soil ingestion for the Site east of the river range from 2×10^{-2} (based on the highest detected concentrations) to 2×10^{-4} (based on mean concentrations). Excess lifetime carcinogenic risks from soil ingestion for the Site west of the river range from 4×10^{-2} (based on the highest detected concentrations) to 3×10^{-4} (based on mean concentrations). The carcinogenic PAHs are the major chemicals contributing to the risks from the Site.

RfDs for lead, cadmium, and 2,4-dinitrophenol, based on highest detected concentrations, were exceeded for a child's soil ingestion exposure scenario with a HI of 12.

3. Current Conditions--River Sediment Exposures

The risks associated with river sediment are summarized in Table 1-e. The river was divided into five 1-mile segments (i.e., river miles) to better characterize the risks associated with exposure to individual river locations and are limited to trespass exposure (most likely to children) resulting from recreational use of the river. Exposure could result form inadvertent ingestion of sediment or direct dermal contact.

Carcinogenic PAHs were detected in all segments of the river and contributed the most to the excess cancer risk levels. Estimated excess cancer risk levels from ingestion exposures based on the highest detected concentration ranged from 1×10^{-4} for river mile 1, to 3×10^{-5} for river mile 5. Cancer risk estimates for average concentrations were greater than 1×10^{-6} for all downstream segments. No RfD values were exceeded for noncarcinogenic exposure at any river mile segment.

The effects of acute dermal exposure to creosote are also a concern, although this risk cannot be expressed quantitatively. Skin irritations resulting from contact with sediment have been documented and are assumed to still exist.

The baseline risk assessment is based on a variety of factors including:

- Sampling and analysis
- Fate and transport estimation
- Exposure estimation
- Toxicological data
- Possible synergistic/antagonistic effects
- Additional routes of exposure

Table 1-d
Summary of Residential Development Risks
Moss-American Site

Exposure Setting	Concentration	Target Population	Noncarcinogenic Risks: Ingestion Hazard Index	Noncarcinogenic Risks: Chemicals Exceeding RfD	Carcinogenic Risks - Ingestion: Total Ingestion Excess Lifetime Cancer Risk	Carcinogenic Risks - Ingestion: Major Chemicals
East	Highest Detected	Child	0.92	None	-	-
	Geometric Mean	Child	0.49	None	-	-
	Highest Detected	Adult	0.099	None	2E-02	PAHs(a)
	Geometric Mean	Adult	0.051	None	2E-04	PAHs(a)
West	Highest Detected	Child	12	Cadmium, lead 2,4-dinitrophenol	-	-
	Geometric Mean	Child	0.5	None	-	-
	Highest Detected	Adult	1.3 b	None	4E-02	PAHs(a)
	Geometric Mean	Adult	0.054	None	3E-04	PAHs(a)

Exposure Assumptions:
Noncarcinogenic Risks - Child: 35 kg body weight 0.2 g/day soil intake.
- Adult: 70-kg body weight, 0.1 g/day soil intake.
Carcinogenic Risks - Lifetime average: 70 kg body weight, 0.1 g/day soil intake.
Exposure daily for 70 years.

a PAHs include benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene.

b No individual chemical intake exceeds RFD. When hazard indexes are re-estimated by health effect, no subindexes exceed 1.

Table 1-e
Summary of Recreational Use Risks
Little Menomonee River

Stream Mile	Concentration	Target Population	Noncarcinogenic Risks - Ingestion: Ingestion Hazard Index	Noncarcinogenic Risks - Ingestion: Chemicals Exceeding RfD	Carcinogenic Risks - Ingestion: Excess Lifetime Cancer Risk	Carcinogenic Risks - Ingestion: Major Chemicals
1	Highest Detected	Child	0.46	None	-	-
	Geometric Mean	Child	0.16	None	-	-
	Highest Detected	Adult	0.20	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.08	None	3E-05	PAHs (a)
2	Highest Detected	Child	0.21	None	-	-
	Geometric Mean	Child	0.14	None	-	-
	Highest Detected	Adult	0.10	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.07	None	2E-05	PAHs (a)
3	Highest Detected	Child	0.32	None	-	-
	Geometric Mean	Child	0.26	None	-	-
	Highest Detected	Adult	0.16	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.13	None	2E-05	PAHs (a)
4	Highest Detected	Child	0.12	None	-	-
	Geometric Mean	Child	0.23	None	-	-
	Highest Detected	Adult	0.06	None	5E-05	PAHs (a)
	Geometric Mean	Adult	0.12	None	5E-06	PAHs (a)
5	Highest Detected	Child	0.56	None	-	-
	Geometric Mean	Child	0.47	None	-	-
	Highest Detected	Adult	0.30	None	3E-05	PAHs (a)
	Geometric Mean	Adult	0.23	None	3E-06	PAHs (a)

Exposure Assumptions
Noncarcinogenic Risks - Child: 35 kg body weight, 0 1 g/day soil intake
- Adult. 70 kg body weight, 0 1 g/day soil intake
Carcinogenic Risks - 70 kg body weight, 0.1 g/day soil intake
Exposure duration 2 days/week for 20 weeks/year, 10 years

a PAHs include benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo[g,h,i]perylene chrysene, dibenz(a h)anthracene, indeno(1.2.3-c,d)pyrene

Within the limits of these assumptions and factors this risk characterization presents a conservative representation of the present and future potential for risk to public health and the environment posed by the contaminated soil, groundwater and sediment.

7. Description of Alternatives

The FS, based on information gathered during the RI, evaluated and screened a wide range of possible technologies to be considered for the final step of the FS process called the detailed evaluation of alternatives. The technologies were then combined into site specific alternatives. The FS identified and evaluated seven alternatives including a no action alternative. The option of on-site disposal of the treatment residue from the Northeast Landfill area was not evaluated in the FS and has been included in the treatment alternatives to accommodate Wisconsin's Hazardous Waste Capacity commitment. Soil and sediment volumes given in the description of alternatives are in-place volumes and correlate to the volumes described as "highly contaminated" in the FS.

ALTERNATIVE 1
- No action

ALTERNATIVE 2
- Reroute river
- Cover contaminated sediment in place
- Cover contaminated soil
- Collect and treat contaminated groundwater
- Remove contaminated soil in Northeast Landfill, incinerate off-site

ALTERNATIVE 3A
- Remove and treat highly contaminated sediment and soil in an on-site slurry bioreactor
- Reroute river
- Cover contaminated sediment in place
- Collect and treat contaminated groundwater
- On-site disposal of residue from treatment of Northeast Landfill soil

ALTERNATIVE 3B
- Remove and treat highly contaminated sediment and soil in on-site land treatment beds
- Reroute river
- Cover contaminated sediment in place
- Cover remaining contaminated soil
- Collect and treat contaminated groundwater
- On-site disposal of residue from treatment of Northeast Landfill soil

ALTERNATIVE 4
- Remove and treat sediment having contaminant concentrations greater than background using on-site slurry bioreactor
- Replace and cover residual on-site with soil
- Cover contaminated soil
- Collect and treat contaminated groundwater
- On-site disposal of residue from treatment of Northeast Landfill soil

ALTERNATIVE 5
- Remove and treat sediment having contaminant concentrations greater than background and highly contaminated soil using on-site slurry bioreactor
- Replace and cover residue on-site with soil
- Cover remaining contaminated soil
- Collect and treat contaminated groundwater
- On-site disposal of residue from treatment of Northeast Landfill soil

ALTERNATIVE 6
- Remove and treat sediment having contaminant concentrations greater than background and soil having contaminant concentrations $>1 \times 10^{-6}$ targets using on-site incineration
- Replace and cover residue on-site with soil

Alternative 1: No Action. A No Action Alternative was evaluated in detail to serve as a baseline for comparison against remedial action alternatives. It assumes that no corrective action will be taken at the site and that no restrictions will be placed on access or on future use of the site. There are no costs associated with this alternative.

Alternative 2: Reroute River; Containment of Sediment and Soil; Treatment of Groundwater; Off-site incineration of the Northeast Landfill Area.

Time to Implement:	**1 - 2 years**
Capital Cost:	**$15,000,000.00**
Annual O&M Cost:	**$ 130,000.00**
Total Present Worth Cost:	**$18,000,000.00**

Under Alternative 2, a new river channel will be dug parallel to the existing Little Menomonee River and the old river bed drained and filled with soil from the new excavation. On-site soil will be consolidated and covered with no treatment. Figure 8 illustrates the components of Alternative 2.

Rerouting River: Construction of the new river bed will proceed from the railroad tracks just south of Brown Deer Road to the confluence of the Little Menomonee River and the Menomonee River downstream of the site. Sediment in the old channel will be covered with soil from the new channel.

Because hazardous substances will be left in place, a soil admixture will be mixed into highly contaminated sediment to reduce the migration potential of the contaminants. An appropriate admixture will be determined during design. A low-permeability backfill will be placed in areas just upgradient of intersections of the old and new river beds to reduce preferential migration of contaminants to the new river.

The proposed river realignment, illustrated in Figure 7, will require a detailed design study to assess the river hydraulics, effects on the wetland and woodland environment, and the effects on existing parkland and utilities. Consideration for enhancement of environmental quality and aesthetics will be addressed as well in the preliminary design phase. Construction of the channel will comply with the guidance established by the WDNR.

Soil: Contaminated on-site soil (about 210,000 cu/yds) will be consolidated out of the flood plain and contained in place by covering it with a 2-foot vegetated soil cover. This includes soil in the 100-year floodplain exceeding the 1×10^{-6} target concentrations. The permeable nature of the cover is intended to enhance groundwater treatment by flushing out the contaminants while preventing direct contact with the contaminated soil and

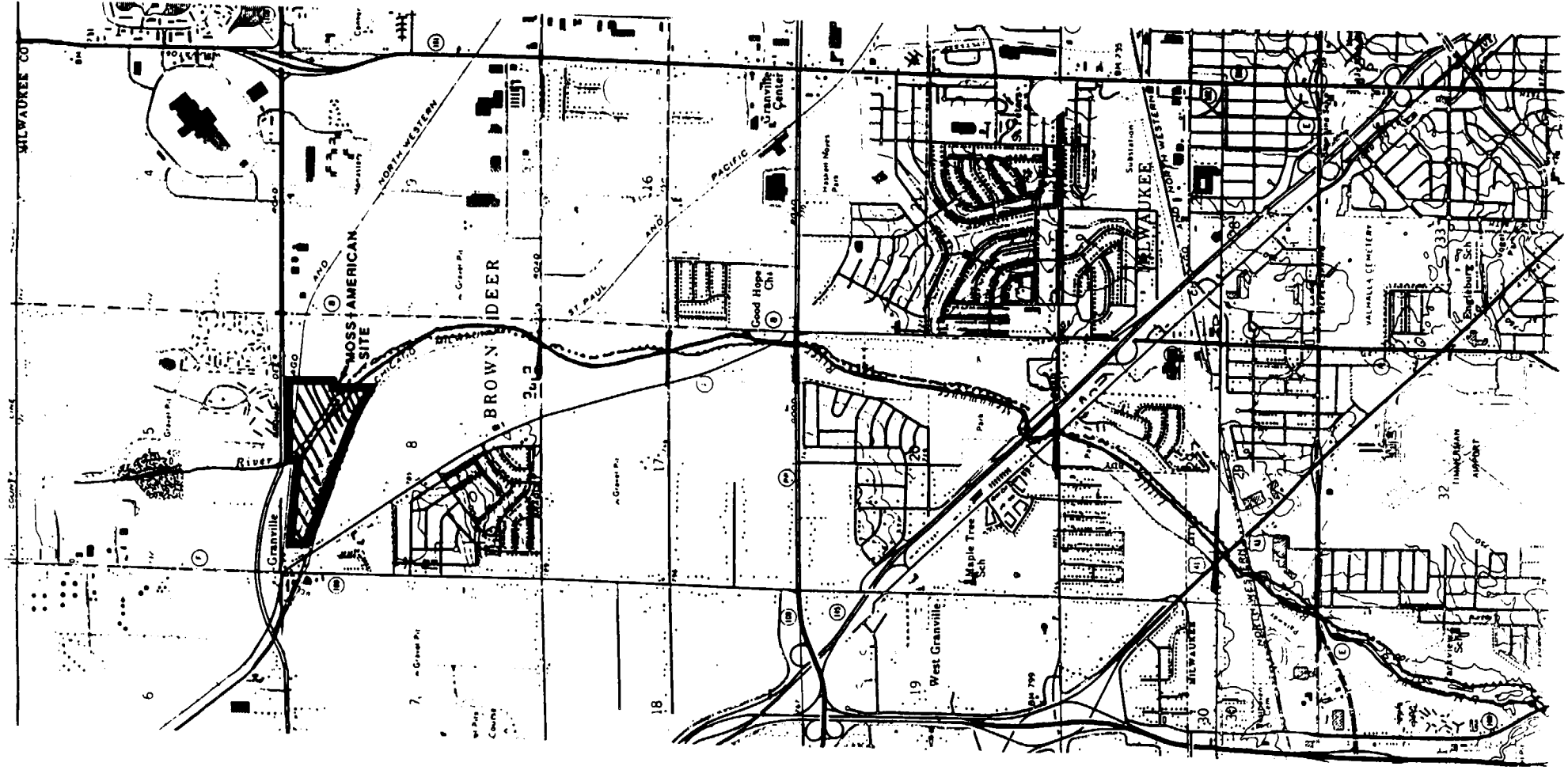


FIGURE 7
PERMANENT RIVER RELOCATION
MOSS-AMERICAN FS

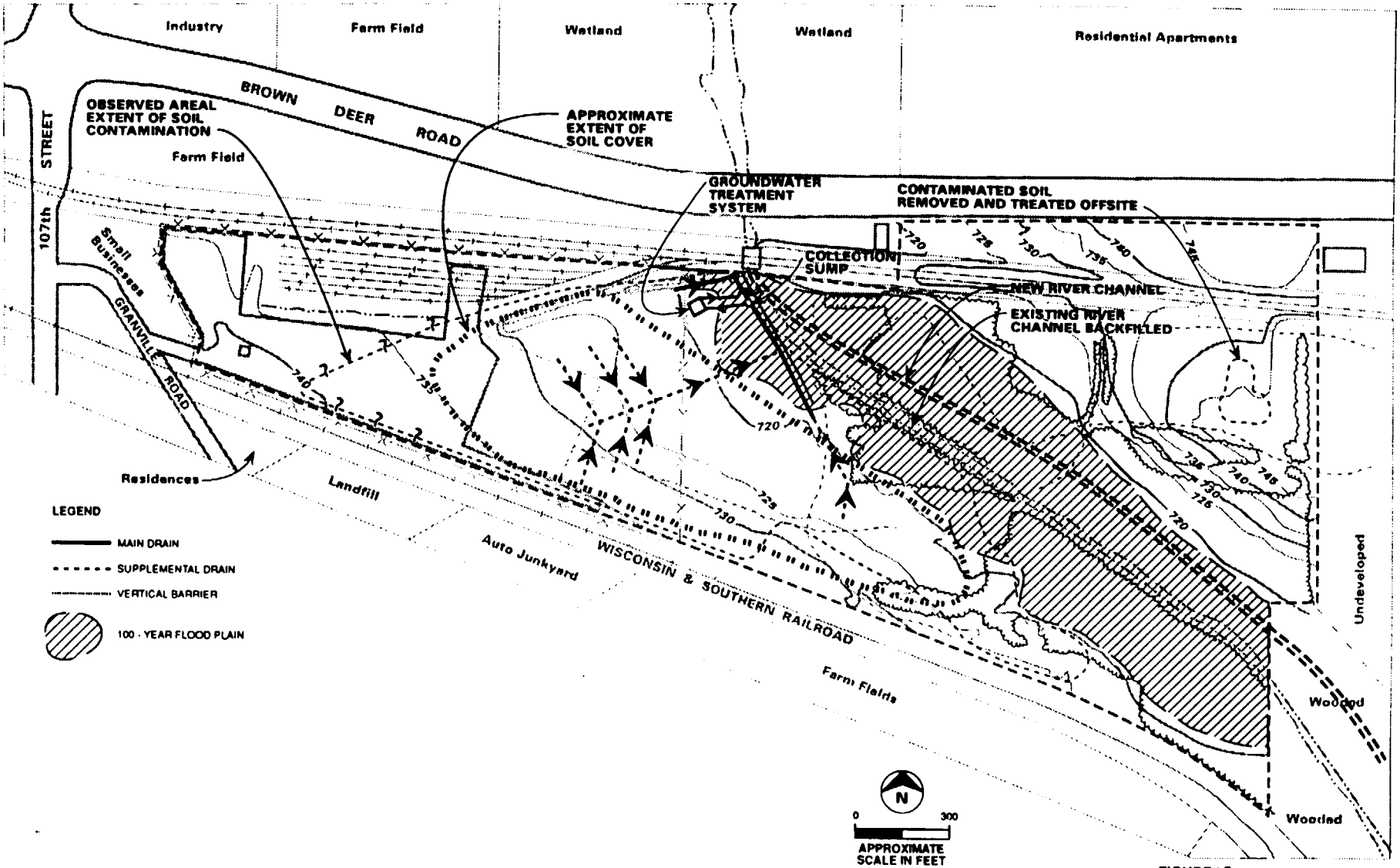


FIGURE : 8
ALTERNATIVE 2 - CONTAINMENT OF SOIL AND SEDIMENT AND TREATMENT OF GROUNDWATER
MOSS-AMERICAN FS

GL085584-FS ALT 2 CONTAIN 3-30-90mms

sediment.

Contaminated soil in the Northeast Landfill, about 1000 cu/yds, will be removed and incinerated off-site at a licensed facility to eliminate the need for long-term maintenance of property east of the river.

Groundwater treatment: Contaminated groundwater from the west side of the river will be collected by a series of supplemental drains that lead into an interceptor drain running parallel to the river, then flowing into a collection sump. The groundwater treatment system is illustrated in Figure 9. A vertical barrier, a synthetic geomembrane liner, will be placed along the east wall of the main drain trench to prevent discharge of contaminated materials to the river and recharge from the river to the collection trench.

The treatment system will be designed to remove nonaqueous phase liquids using an oil/water separator, and semivolatiles using granular activated carbon or a comparable method demonstrated in the predesign phase of remedial design. The treated water will be discharged to the POTW or the river if the former is not possible. The treatment system will be designed to achieve the effluent limits established by the WDNR (see Table 2 below).

Table 2
Water Quality-Based Effluent Limits for the Moss-American Site

Chemical	Daily Maximum (ppm)	Monthly Average Limit (lb/day)	Annual Average Limit (lb/year)
Ethylbenzene	45	200	--
2,3,7,8-TCDD	--	1.9 x 10-9	6.9 x 10-7
Chloroform	29	1.6	--
Total CPAHs	--	1.9 x 10-3	0.68

The sewer is located on-site, just east of the river. Discharge to the sewer, and consequently to the Jones Island POTW, requires that the total VOC concentration be less than 5 mg/l. A Notice of Intent to Discharge Industrial Wastewater must be filed with the POTW.

Pure phase liquids collected will be hauled off-site for treatment at a RCRA incinerator. The activated carbon will periodically be removed and recharged off-site, and ultimately disposed of at a RCRA facility. The time period over which groundwater treatment will be required is difficult to predict because of the heterogeneities in subsurface soil, the relatively low mobility of the contaminants of concern (PAHs), and the low hydraulic conductivities observed on-site. Since the source will remain on-site, cleanup could take in excess of 200 years.

Groundwater cleanup standards: The cleanup standards for

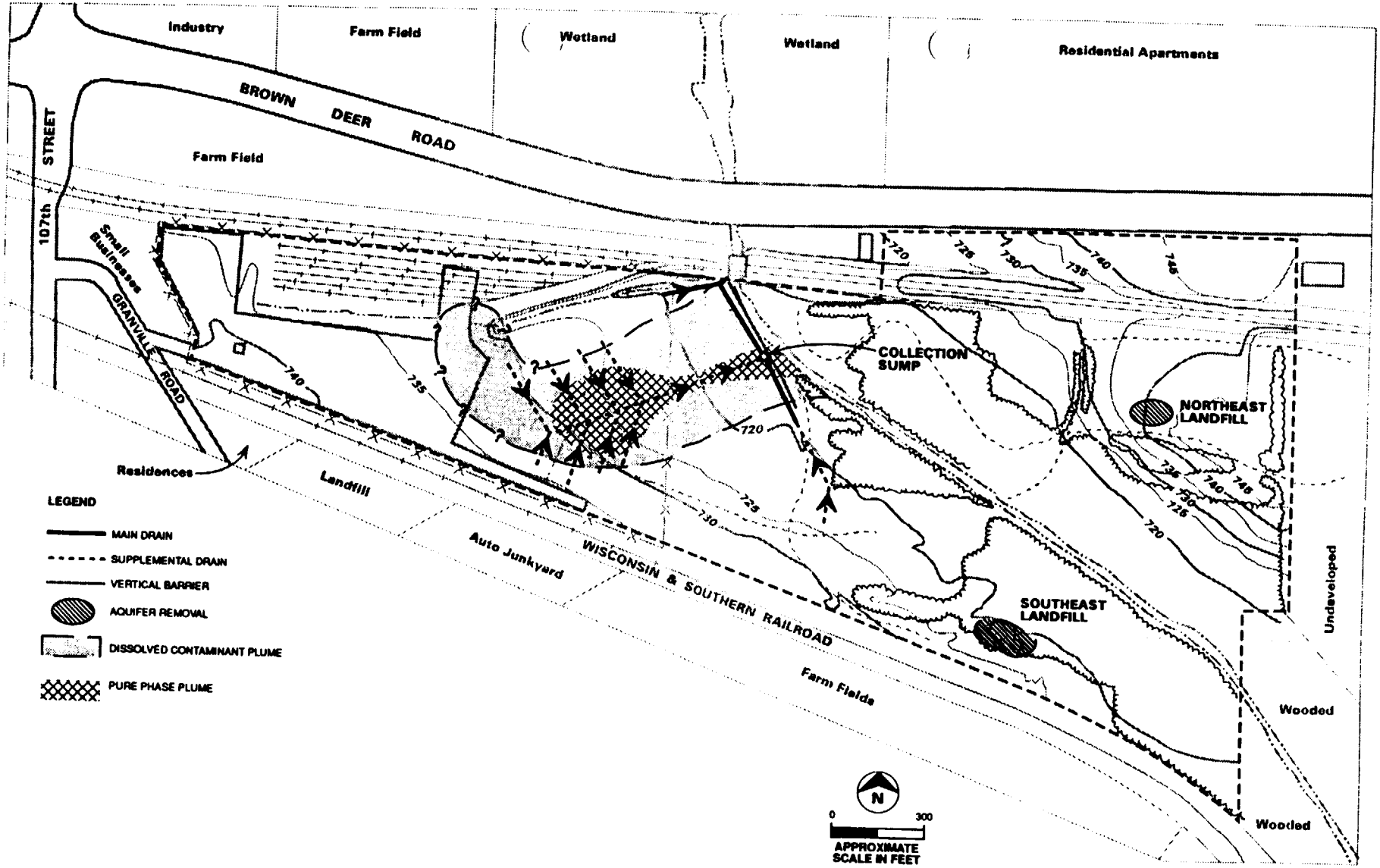


FIGURE 9
RECOMMENDED GROUNDWATER REMEDIAL ACTION
MOSS-AMERICAN FS

GL:083584 AS Recom Groww Remed Action 5-16-90mms

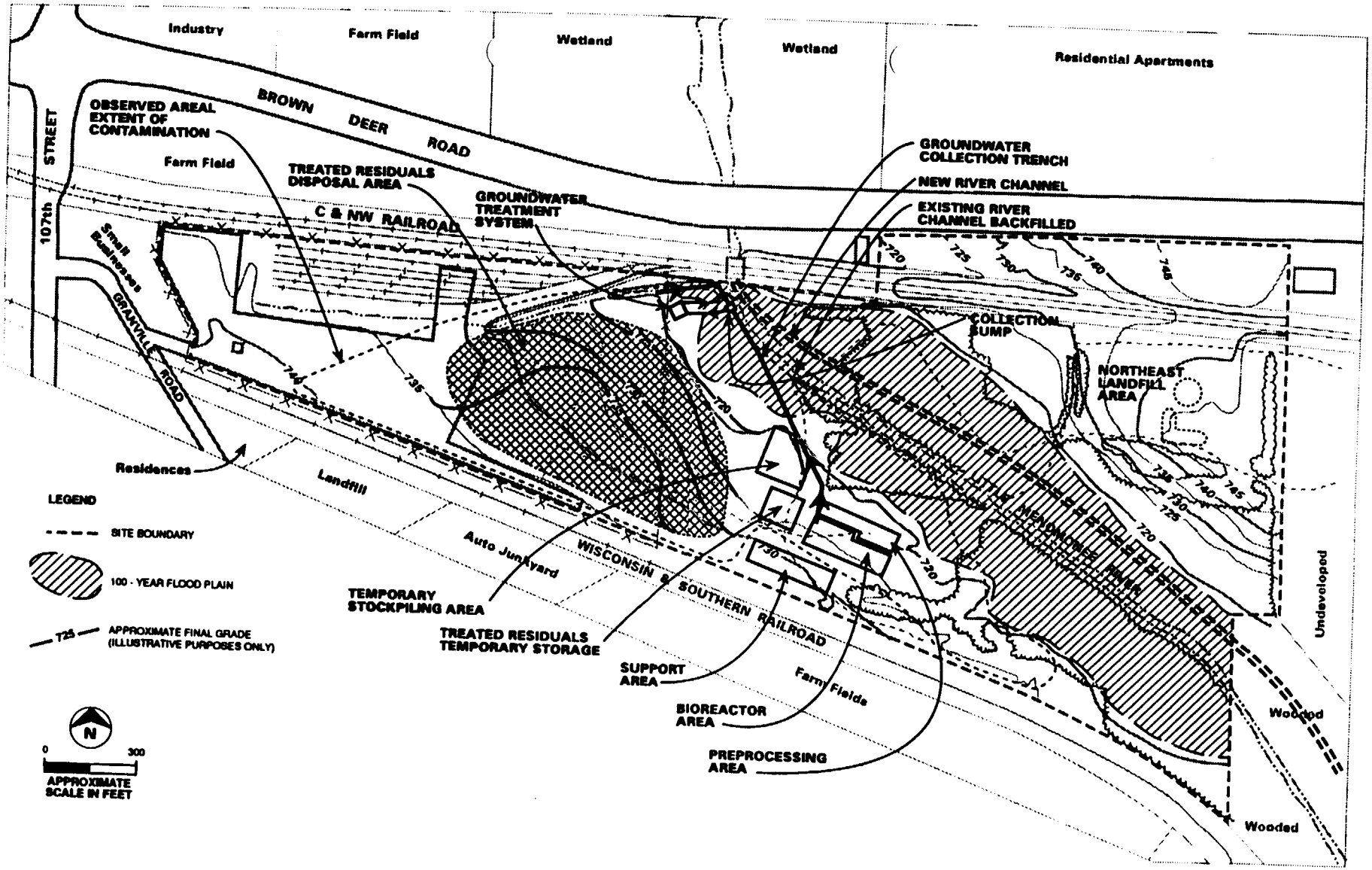


FIGURE 10
ALTERNATIVE 3A - SLURRY TREATMENT OF SOIL AND SEDIMENT AND TREATMENT OF GROUNDWATER
MOSS-AMERICAN FS

groundwater are the preventive action limits (PALs) for the following B-E-T-X compounds:

	ES (ug/l)	PAL (ug/l)
Ethylbenzene	1360.0	272.0
Benzene	0.67	0.067
Toluene	343.0	68.6
Xylene	620.0	124.0

Groundwater quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met. If, after the ground-water operable unit has been operating for a minimum of 5 years, it becomes apparent that it is not technically or economically feasible to achieve the PAL, then a Wisconsin alternative concentration limit (WACL) may be established in compliance with the criteria in NR 140.28 of the Wis. Adm. Code. The WACL that is established may not exceed the enforcement standard (ES) for that compound. Refer to Section 10.2.3. Chemical Specific ARARs for a discussion of the point of compliance. The groundwater cleanup standards are the same for all alternatives.

Under Alternative 2 and the following alternatives, groundwater monitoring will be conducted in the area of the contained soil. Four wells will be sampled on a quarterly basis and eight others will be sampled annually.

Alternative 3A: Reroute River; Partial Removal and Treatment of Highly Contaminated Sediment and Soil by Bioslurry; Containment of Remaining Sediment, Soil and Treatment Residue; Treatment of Groundwater.

Time to Implement:	**3 - 4 years**
Capital Cost:	**$25,000,000**
Annual O&M Cost:	**$ 130,000**
Total Present Worth Cost:	**$26,000,000**

Under Alternative 3A, the little Menomonee River will be rerouted as described in Alternative 2, but the contaminated sediment will be removed and treated on-site. The remaining contaminated sediment will be covered in place with the soil excavated from the new channel. The components of Alternative 3A are illustrated in Figure 10.

Reroute of River: The new river channel will be constructed parallel to the existing channel. Construction of the new river bed will proceed from the railroad tracks just south of Brown Deer Road to the confluence of the Little Menomonee River and the Menomonee River downstream of the site. The river will then be diverted to the new channel. Following the diversion of the river, the old channel will be drained and highly contaminated

sediment removed by backhoe or end loader before backfilling the old channel. Refer to Appendix B of the FS for a discussion of possible construction techniques and approaches. The removal equipment will load the sediment into a lined truck for hauling to the site for treatment.

The proposed river realignment, illustrated in Figure 7, will require a detailed design study to assess the river hydraulics, effects on the wetland and woodland environment, and the effects of existing parkland and utilities. Consideration for enhancement of environmental quality and aesthetics will be addressed as well in the preliminary design phase. Construction of the channel will be undertaken in consultation with the WDNR and the guidance established by the WDNR.

Soil and Sediment removal and treatment: Highly contaminated soil (80,000 cu/yds) and river sediment (5,200 cu/yds) will be removed and treated on-site using the slurry bio-reactor technology. The removal criterion of "highly contaminated soil or sediment" is defined as an extractable organic (EO) level of 1000 mg/kg or greater, or the presence of tarry or oily material and/or a creosote odor. The removal of highly contaminated soil and sediment is expected to remove all contaminated materials that exceed a risk level of 1×10^{-4}, which is defined as 6.1 mg/kg of CPAHs in soil, and 388 mg/kg of CPAHs in sediment. This criterion was developed with the intent of removing the contaminated material with the greatest migration potential and thereby preventing further releases to the environment. The removal criterion methodology will be further refined in the design phase of the remedial action. The soil and sediment removed will be treated to achieve the clean up level of 6.1 mg/kg of CPAHs, the target compound.

The bioslurry treatment, a two-part process, is illustrated in Figure 11. The soil will be screened to remove oversized debris and washed in an attrition scrubber. The washed soil that meets clean up levels will be placed back on-site. Oversize material will be treated according to Best Management Practices, i.e., triple wash or rinse, test/treat wash water in the groundwater treatment system, and placed back on-site, if possible, in the unit receiving the treatment residue. The volume of this material is estimated at 500 - 3000 cu/yds. The remaining soil will be "slurried", water is added to it to achieve optimum moisture content, and pumped to the reactor tank along with the sediment for treatment.

Slurry bioreactors treat contaminated soil by mixing the slurry with microorganisms in an aerated reactor tank. The reactor provides a favorable environment for microbial growth and maintains contact between the contaminants and microorganisms performing the degradation. As with other biological treatment processes, temperature, pH, oxygen, and contact between

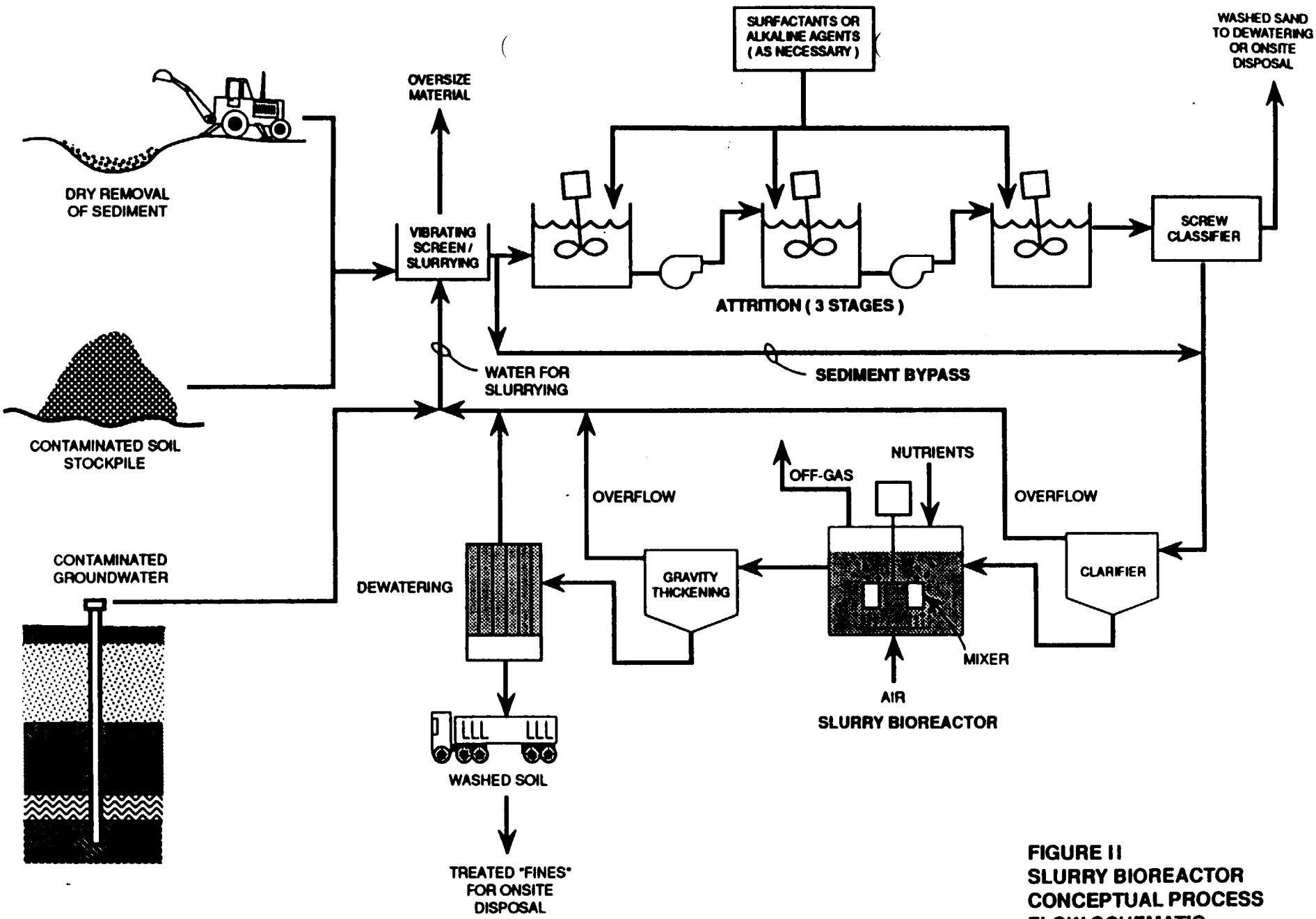


FIGURE II
SLURRY BIOREACTOR
CONCEPTUAL PROCESS
FLOW SCHEMATIC
MOSS-AMERICAN FS

contaminants and microorganisms are critical factors controlling the rate of degradation. Because these parameters can be more easily controlled in an enclosed reactor than in a treatment bed, slurry bioreactors achieve faster rates of degradation. Figure 11 is a conceptual process flow schematic for a slurry bioreactor system.

Following degradation in treatment tanks, the slurry will be piped to a thickener for separation. Solids will be further dewatered before deposition back on-site, while the liquid phase will be recycled. Wastewater generated from the dewatering step will either be recycled for slurrying, or treated on-site prior to discharge to the river. Activated carbon or filtration may be employed before discharge if necessary.

The slurry will be discharged to a settling tank and dewatered. Dewatered soil and sediment (treatment residue) meeting cleanup levels will be covered on-site, along with the remaining soil, with two feet of soil, six inches of topsoil, and revegetated as in Alternative 2. Treatment residue not meeting cleanup levels will be retreated.

Wastewaste generated from the dewatering step will either be recycled for slurrying, or treated on-site in the groundwater treatment system prior to discharge to the POTW or the river.

Note: Because the contaminated soil and sediment contain a listed hazardous waste, K001, treatment must comply with Land Disposal Requirements (LDRs). Because existing and available data do not demonstrate that the full-scale operation of this treatment technology can attain the LDR treatment standards consistently for all soil and debris wastes to be addressed by this action, this alternative will comply with the LDRs through a Treatability Variance for the wastes that cannot be treated to meet the standard, as outlined in 40 CFR 268.44 and OSWER Directive 9347.3-06FS: wastes will be treated until concentrations of constituents restricted in the LDRs are below the limits set by the Treatability Variance, and concentrations of CPAHs are below health-based targets (1×10^{-4} excess lifetime cancer risk) for soil (see the FS, Chapter 4 and Table 3 of this document for specific treatment levels).

Bench-scale testing of a system similar to slurry biotreatment was performed as part of the RI (see Appendix K of the Feasibility Study) that indicated a 15-day retention time will achieve the desired cleanup goal of 6.1 ppm CPAHs. Pilot tests will be performed during preliminary design to more accurately determine retention time to achieve cleanup goals. Since the effectiveness of biological treatment methods is temperature dependent, it is not expected that treatment will continue during the winter; the design phase will also look at methods of extending the months available for treatment. Other preliminary

Table 3

TREATMENT LEVELS TO BE OBTAINED TO COMPLY WITH LDR TREATBILITY VARIANCE

Contaminant	Reference Concentration (mg/Kg)	1x10-4 Excess Lifetime Cancer Risk Target (mg/Kg)	Observed Concentration Range (mg/Kg)	Threshold Concentration (mg/Kg)	Concentration Range To Be Achieved (mg/Kg)
LDR CONSTITUENTS FOR K001					
Pentachlorophenol	2250	NA	BDL	400 (TWA)	95 percent reduction
Napthalene	30000	"	0.019 - 2600	400 (TWA)	or 20 mg/Kg (TWA)
Phenanthrene	--	"	0.06 - 4600	400 (TWA)	"
Pyrene	225	"	0.016 - 2000	400 (TWA)	"
Toluene	22500	"	0.002 - 2.0	100 (TWA)	90 precent reduction
Xylene	150000	"	0.002 - 17	100 (TWA)	or 10 mg/Kg
Lead	--	"	2.3 - 519 (TWA)	300 (TCLP)	3 mg/Kg (TCLP)
CONTAMINANTS OF CONCERN					
2,4-dinitrophenol			620	NA	NA
Cadmium	37.5		1.6 - 76	"	NA
Chrysene	NA	6.1	0.038 - 510	"	90 percent reduction
Benzo(a)anthracene	"	6.1	0.069 - 420	"	or sum of carcinogenic
Benzo(a)pyrene	"	6.1	0.040 - 230	"	PAHS < 6.1 mg/Kg
Benzo(b)fluoranthene	"	6.1	0.010 - 270	"	"
Benzo(k)fluoranthene	"	6.1	0.014- 250	"	"
Benzo(ghi)perlyene	"	6.1	0.044 - 77	"	"
Dibenz(ah)anthracene	"	6.1	0.051 - 24	"	"
Ideno(123cd)pyrene	"	6.1	0.029 - 78	"	"
Sum of carcinogenic PAHs		6.1	<0.33 - 1900		"

NOTES

1. Concentration ranges defined in "Superfund LDR Guidance, #6A"; OWSER 9347,3-06FS.
2. Only the concentration range for LDR constituents for K001 need to be attained to comply with LDRs.
3. Contaminants of concern include only the primary contaminants of concern identified in the baseline risk assessment.
4. Observed concentration range for soil and sediment.
5. No threshold concentrations developed for toluene and xylene. Ranges based on "Other Polar Organics" category.
6. Treatability Variance applies to Alternatives 3A, 3B, 4, and 5.

design tasks include:

* A sampling survey to better define the volume of contaminated soil and sediment to be managed;

* Additional flood plain sampling to verify extent of contamination;

* Further characterization of groundwater conditions and contamination potential on east side of the river;

* Establishment of dewatering design to lower groundwater for soil removal;

* Further investigate the possible extent of soil and groundwater contamination in the pit and ditch area;

* Incorporation of results of the seasonal fluctuation in groundwater elevation study already in progress;

* Refining of verification methods for determining contamination levels in the field;

* Establishment of background PAH concentrations that are more in keeping with the SQC values for areas where the old and new channels tie in to pass under bridges.

* Environmental design studies described under Flood Plain and Wetland ARARs in Section 10.2.2.

Groundwater Collection and Treatment: Groundwater treatment and cleanup standards are the same as Alternative 2, but, because much of the source of groundwater contamination will be removed for treatment, supplemental drain systems may not be necessary and the treatment time will be shortened to less than ten years. In addition, some of the groundwater treatment can be incorporated into the slurry treatment when the system is in use, i.e., the collected groundwater can be used to slurry the soil. As in Alternative 2, the groundwater cleanup standard is the PAL for the B-E-T-X compounds:

	ES (ug/l)	PAL (ug/l)
Ethylbenzene	1360.0	272.0
Benzene	0.67	0.067
Toluene	343.0	68.6
Xylene	620.0	124.0

Groundwater quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met. If, after the ground-water operable unit has been operating for a minimum of 5 years, it becomes apparent that it is not

technically or economically feasible to achieve the PAL, then a WACL may be established. The WACL that is established may not exceed the ES for that compound.

As described under Alternative 2, groundwater monitoring will be conducted in the area of the contained soil. Four wells will be sampled on a quarterly basis and eight others will be sampled annually.

Northeast Landfill treatment: Contaminated soil in the Northeast Landfill, about 1000 cu/yds, will be removed, treated on-site in the slurry biotreatment unit, and the residue disposed of on-site within the AOC along with the other treatment residue and consolidated soil as described in the following paragraph. The FS evaluated off-site disposal for this alternative. On-site disposal will accommodate Wisconsin's Hazardous Waste Capacity commitment and will also provide a disposal unit for debris that will otherwise require disposal off-site.

Cover: Treatment residue generated from the slurry bioreactor, and on-site contaminated soil exceeding the 1×10^{-6} target concentrations, a total of about 210,000 cu/yds, will be contained within the AOC, covered with 2 feet of clean soil and 6 inches of topsoil. The cover will be vegetated to reduce erosion and improve aesthetics. To further reduce the likelihood for exposure to the contained soil and residue, deed restrictions will be placed on the site to prevent its development and the area of contained soil will be fenced. U.S. EPA has determined that, while a RCRA-type closure is applicable to waste within the AOC, because placement has occurred, it is not technically suitable.

The nature of the waste, its distribution, and the principal routes of exposure indicate that an impermeable cap, liner, and leachate collection system would decrease the efficiency of the groundwater treatment system, prolonging the treatment time and providing no benefit over the proposed hybrid soil cover - Proposed NCP page 51446. A hybrid soil cover is considered equally as effective in limiting soil ingestion, but would permit natural flushing to the groundwater collection and treatment system, and encourage biodegradation of hazardous substances in the vadose zone. If natural flushing does not occur, groundwater collection and treatment could take in excess of two hundred years during which time hazardous waste would remain on-site, posing considerable risk to human health and the environment. For this reason, pursuant to CERCLA section 121(d), the Greater Risk to Health and the Environment waiver will be invoked to meet State RCRA closure requirement for an impermeable cap, liner, and leachate collection system.

Alternative 3B: This alternative is the same as Alternative 3A except that it uses a biological land treatment system rather than a slurry bioreactor to treat contaminated soil and sediment.

Time to Implement:	**8 - 15 years**
Capital Cost:	**$22,000,000**
Annual O&M Cost:	**$ 500,000**
Total Present Worth Cost:	**$26,000,000**

Under Alternative 3B, the Little Menomonee River will be rerouted as described in Alternative 3A. Highly contaminated soil and sediment will be removed and placed on land treatment beds to biologically degrade the contaminants of concern: an estimated 80,000 cu/yds of soil and 5,200 cu/yds of sediment will be removed and treated over the course of 8 to 15 years. Figure 12 illustrates the components of Alternative 3B. All components other than the land treatment beds are the same as described in Alternative 3A.

Removal and treatment of soil and sediment: The 10 acre treatment beds will be located west of the river, over the old storage and disposal areas as illustrated in Figure 12. At a soil application thickness of 1 foot, it will be possible to treat about 16,000 cu/yds of soil at a time. Because soil there is already contaminated, a temporary soil stockpiling area will be constructed to accommodate the material while the treatment beds are being constructed. The stockpiling area will be designed to contain and collect leachate from the pile.

Before stockpiling, soil will be screened to remove oversized debris. The oversized debris will be treated as in Alternative 3A except for wood chips which will be managed along with the contaminated soil in the treatment beds.

The land treatment system is depicted in Figure 13. The treatment beds will consist of a layer of clay overlain by a synthetic liner in turn overlain by a sand layer, a primary synthetic liner, and another sand layer. The beds will contain drains for collecting leachate generated during treatment. A 1-foot layer of contaminated soil and dewatered sediment placed on the beds will be periodically tilled to maintain aerobic conditions in the soil. Sewage sludge, manure, or another suitable material could be tilled into the soil to provide nutrients for the micro-organisms. Leachate collected from the treatment beds will be conveyed to a holding tank where it will either be recycled to the groundwater treatment unit or discharged to the sanitary sewer.

Average soil CPAH concentrations are estimated to be 500 to 600 mg/kg and average sediment CPAH concentrations 200 to 400 mg/kg. Results of a treatability test (see Appendix K) indicate that 6

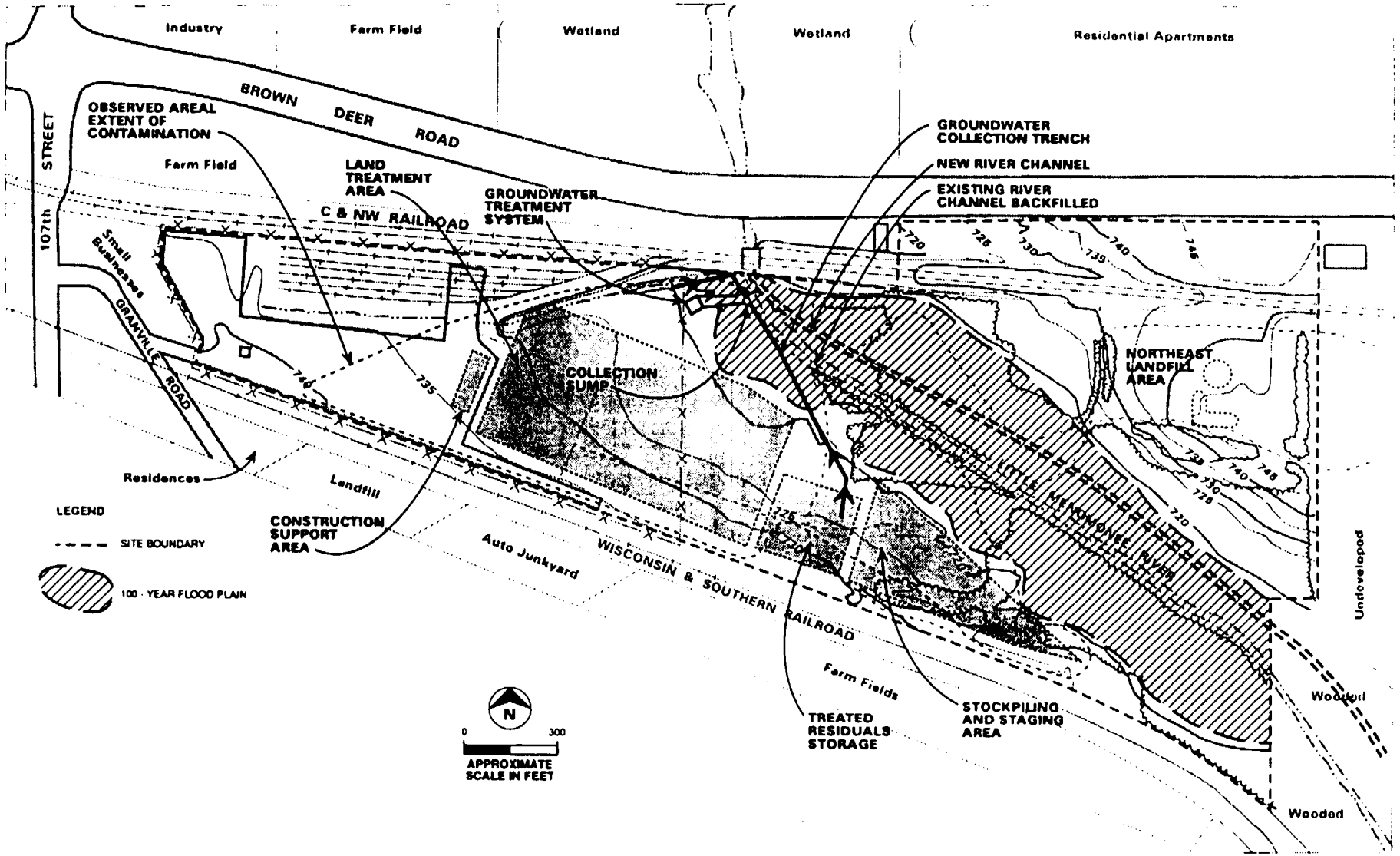


FIGURE 12
ALTERNATIVE 3B - LAND TREATMENT OF SOIL AND SEDIMENT AND TREATMENT OF GROUNDWATER
MOSS-AMERICAN FS

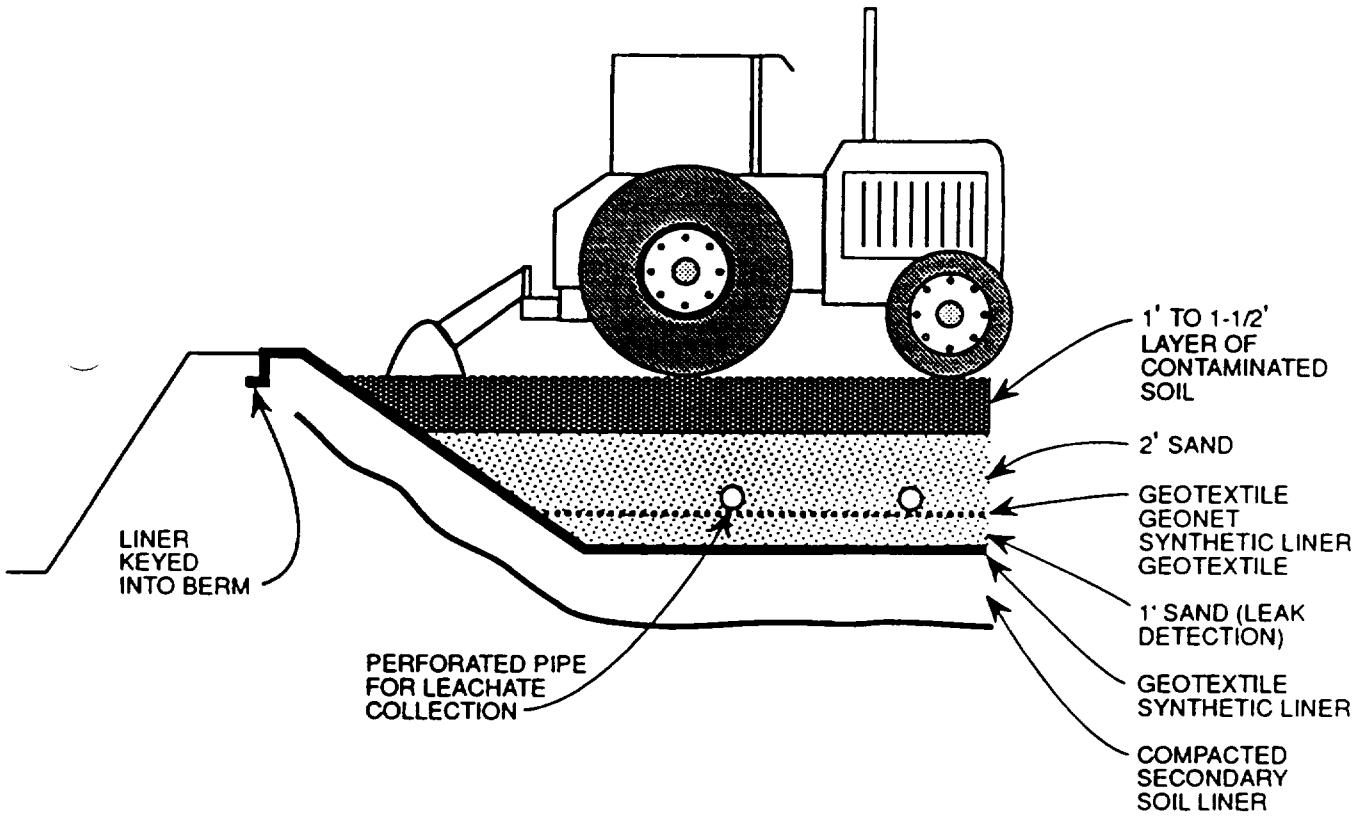


FIGURE 13
CONCEPTUAL CROSS SECTION OF LAND TREATMENT BED
MOSS-AMERICAN FS

to 12 months of treatment will be required to achieve cleanup levels. Actual residual PAH concentrations and the length of time it will take to achieve them will be determined by pilot studies during the remedial design phase. Cold temperatures will limit the treatment season to May through September.

Treated soil and sediment will be placed in a lined storage bed west of the river until all contaminated soil and sediment could be treated. This alternative will comply with LDR treatment requirements through a Treatability Variance as in Alternative 3A. Once all of the soil and sediment, including that from the Northeast Landfill area, has been treated, the stockpiled (treated) soil and sediment will be placed back on the treatment beds, covered with soil, and planted with vegetation. Leachate from the treatment beds will continue to be collected, treated, and monitored.

Groundwater Collection and Treatment: Groundwater will be collected and treated as in Alternative 3A. Management of residuals is the same except that oil sludge and skimming could be treated in the on-site treatment beds.

Alternative 4: Removal and Treatment of Sediment only; Containment of soil; Groundwater Treatment, does not Reroute River.

Time to Implement:	**1 - 2 years**
Capital Cost:	**$17,000,000**
Annual O&M Cost:	**$ 130,000**
Total Present Worth Cost:	**$20,000,000**

Under Alternative 4, 33,000 cu/yds of contaminated sediment with concentrations of contaminants exceeding background CPAH levels (currently estimated at 18 ppm) will be removed and treated by slurry bioreactor. Residue from the slurry bioreactors will be consolidated with contaminated on-site soil and covered. Unlike Alternatives 3A and 3B, which also excavate and treat sediment, the Little Menomonee River will not be rechanneled. As with Alternative 3A, contaminated soil in the Northeast Landfill area will be treated on-site and the residue disposed of on-site in a RCRA compliant unit.

Sediment removal and treatment: Removal and treatment of the sediment uses the same methods as Alternatives 3A and 3B, but, since no new channel is being constructed, the river will temporarily bypass segments to be excavated. This will be achieved by damming the upstream end and bypassing or pumping water around the area of excavation during the removal (see Appendix B of the Feasibility Study). The difference between Alternative 4 and Alternatives 3A and 3B is that a greater amount of sediment will be removed because the existing river alignment will remain the same. Some reconstruction and modifications to

the channel will be necessary to provide stable banks and to mitigate impacts on wetlands. Appendix B of the FS describes the requirements of channel reconstruction.

Removal of sediment exceeding background CPAH levels will reduce acute exposure risks to humans to 1 x 10^{-5} and significantly reduce both acute and chronic risks to aquatic life. The level of 18 ppm CPAHs may not be sufficiently protective for aquatic life. Wisconsin Sediment Quality Criteria, a To Be Considered (TBC), indicates that 3 ppm, which equates more closely to the 1 x 10^{-6} risk level for sediment, is required. Because of the irregular distribution of contaminants and physical limitations of the removal equipment, the actual difference in sediment volume removed, 18 ppm versus 3 ppm, may not be significant. More of a problem is that this concentration approaches detection limits and more exact field verification methods will be required. This verification will require more sensitive mobile laboratory detection methods, and that a greater number of samples be taken to determine if sediment removal was sufficient to meet criteria.

As in Alternative 3A, Alternative 4 will comply with LDR treatment requirements through a Treatability Variance and sediment will be treated until the residue have concentrations less than the health-based limits (1 x 10^{-4} excess lifetime cancer risk) for soil or 6.1 ppm CPAHs.

Soil: All contaminated soil in the AOC, will be consolidated and contained in place beneath a soil cover. As with Alternative 3A, contaminated soil in the Northeast Landfill area will be treated on-site and treatment residue disposed of on-site along with the treatment residue from the sediment.

Groundwater Collection and Treatment: Contaminated groundwater will be collected and treated as under Alternative 2. Since the source is still on-site, groundwater collection and treatment could take more than 100 years.

Alternative 5: Removal and Treatment of Soil and Sediment; Groundwater Treatment.

Time to Implement:	**4 - 6 years**
Capital Cost:	**$23,000,000**
Annual O&M Cost:	**$ 130,000**
Total Present Worth Cost:	**$24,000,000**

Alternative 5 combines components of Alternative 3A and Alternative 4. The treatment method, target concentration of treatment residue, and disposal of residue for sediment and soil is exactly the same as Alternative 3A; also the same is groundwater treatment, and treatment and disposal of the Northeast Landfill contents. As in Alternative 4, the river is

not rerouted and sediment having concentrations of contaminants exceeding background CPAH levels are removed and treated.

Sediment Removal and Treatment: The river sediment removal method, the volume removed, and the treatment is the same as Alternative 4 and will also comply with LDR treatment requirements through a Treatability Variance, treating to less than 6.1 ppm CPAHs.

On-site Soil: The volume of soil, removal and treatment is the same as Alternative 3A and will also comply with LDR treatment requirements through a Treatability Variance, treating to less than 6.1 ppm CPAHs.

Groundwater Collection and Treatment: The groundwater treatment system and management of residuals is as described for Alternative 3A. The groundwater treatment period is estimated to be less than 10 years.

Alternative 6: Incineration of Soil and Sediment.

Time to Implement:	**4 - 5 years**
Capital Cost:	**$89,000,000**
Annual O&M Cost:	**$ 18,000**
Total Present Worth Cost:	**$89,300,000**

Alternative 6, proposes to excavate and incinerate all soil exceeding the 1×10^{-6} risk target concentrations and sediment exceeding background CPAH levels (currently estimated at 18 ppm) on-site using mobile incinerators. The river will not be rerouted. Soil and sediment will be treated to 1×10^{-6}, or .06 ppm CPAH. This treatment level will meet LDRs, a Treatability Variance will not be required. Treated soil and sediment will be replaced on-site, covered, and delisted. Groundwater collection and treatment will probably not be required following the removal of source material. Figure 14 illustrates the components of Alternative 6.

Sediment Removal: The river will be temporarily rerouted segment by segment and contaminated sediment removed as in Alternatives 4 and 5. To decrease the cost of incineration and to increase the processing rate, the sediment will be dewatered before incineration. An estimated 33,000 cubic yards of sediment will be incinerated.

On-site Soil: Soil above the water table with contaminant levels exceeding the 1×10^{-6} target risk range, and soil below the water table with CPAH concentrations greater than 10 mg/kg, about 130,000 cu/yds, will also be excavated and incinerated. This will include contaminated soil in the Northeast Landfill area. It is estimated that the maximum depth of excavation will be about 20 feet.

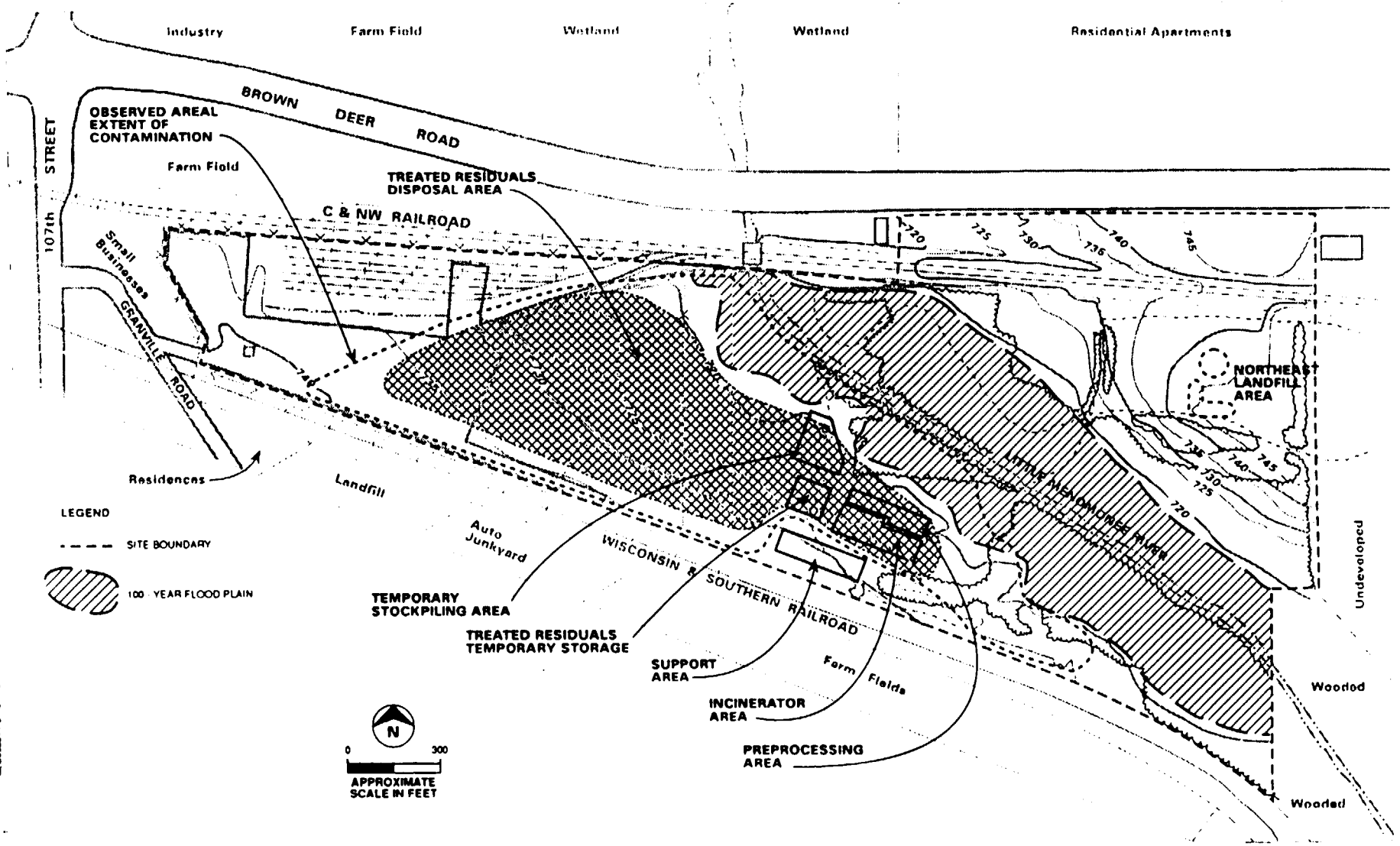


FIGURE 14
ALTERNATIVE 6 - INCINERATION OF SOIL AND SEDIMENT AND TREATMENT OF GROUNDWATER
MOSS-AMERICAN FS

Treatment by Incineration of Sediment and On-site Soil: Based on the large volume of contaminated soil and sediment (about 160,000 cu/yds, two on-site incinerators will be required. Operation will continue throughout the year. Because the proposed location for the treatment facility is over contaminated soil, the first phase of the project will require temporary relocation (stockpiling) of the soil underneath the area of the treatment system. As in Alternatives 3B, the stockpile area will be designed to collect any leachate or runoff from the area, and to direct the leachate to a treatment system. A conceptual layout and more specific information about this alternative can be found in Chapter 3 of the FS. Approximately 100,000 cu/yds of treated soil (ash) will be generated from the incineration.

Management of Residuals: Treated soil and sediment will be replaced in the former storage area. Since the concentrations in soil and sediment will be reduced to below the 1×10^{-6} target level, long-term management of these residue will not be required for the protection of human health. The area of disposal will be covered with soil and planted with vegetation. Residue generated from the treatment of materials removed from the Northeast Landfill area will also be disposed of on-site, since all residuals generated from thermal treatment are expected to be delisted. Oversized material that could not be incinerated on-site will be disposed of off-site in a RCRA-compliant landfill.

Groundwater Collection and Treatment: Since soil at depths of 5 to 10 feet below the water table will be removed, it is anticipated that groundwater collection and treatment will not be required beyond the period of remedial action construction. Groundwater treatment is the same as that described for Alternative 3A.

8. Summary of Comparative Analysis of Alternatives

The alternatives are evaluated against the nine criteria contained in the NCP (40 CFR 300.430)(e)(9)(iii), by balancing long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short term effectiveness and implementability with the cost of the remedy. This evaluation determines the most protective and cost-effective alternative that will meet the objectives of the Feasibility study at the Moss-American Site. The nine criteria are as follows:

1) Overall Protection of Human Health and the Environment.

U.S. EPA measures each alternative by how effectively risks posed by each exposure pathway are eliminated, reduced, or

controlled through treatment, engineering controls, or institutional controls.

2) Compliance with Applicable or Relevant and Appropriate Regulations (ARARs).

The alternatives are evaluated for compliance with State and Federal ARARs determined to be applicable, or relevant and appropriate to the site or provide grounds for invoking a waiver.

3) Long-Term Effectiveness and Permanence.

This criterion relates to the degree of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4) Reduction of Toxicity, Mobility, or Volume through Treatment.

This criterion relates to the anticipated performance of the treatment technologies a remedy may employ.

5) Short-Term Effectiveness.

This criterion addresses the period of time needed to achieve protection against any adverse impacts on human health and the environment that may be posed during the remedy's construction and implementation period, until clean-up goals are achieved.

6) Implementability.

This criterion addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7) Cost.

This criterion includes estimated capital costs, operation and maintenance costs, and present net worth costs.

8) State Acceptance.

This criterion addresses the State's comments.

9) Community Acceptance.

This criterion summarizes the public's general response to

the alternatives described in the proposed plan and RI/FS report.

1) Overall Protectiveness of Human Health and the Environment

With the exception of the No-Action alternative (Alternative 1), each of the alternatives is protective of human health and the environment and will reduce site-related risks to health based levels and an acceptable risk range of 1×10^{-4} to 1×10^{-6}. The technologies employed for treatment alternatives are considered reliable, and will be pilot or field tested to refine their effectiveness. Alternatives 3A, 3B, 5 and 6 reduce all site risk levels to less than 1×10^{-4} through treatment. Alternative 2 and 4 do not provide as much overall protectiveness because soil contamination will be covered but not reduced in toxicity.

All alternatives will be protective of aquatic habitat and the river corridor by either removing the contaminated sediment or providing a clean channel for the river. There is, however, a greater likelihood that the re-routing alternatives (2, 3A, and 3B) will provide better protection of the aquatic habitat because, in addition to providing a clean channel that meets Wisconsin's SQC, shown in Table 4, the new channel could be constructed in a way that more closely resembles the historical stream characteristics, i.e. prior to dredging.

Alternative 2, while adequate, is considered the least reliable since all the contaminant mass is contained in place. Contaminants in sediment could migrate back to the new river, and contaminants in contained soil could be exposed in the future if deed restrictions are not in effect.

2) Compliance with ARARs

All alternatives except the No-Action Alternative will comply with ARARs. Alternatives 4, 5, and 6 do not meet Wisconsin's SQC, which though not ARARs, are TBC. Section 10, the Statutory Determinations section- discusses ARARs for the Alternative 3A, the preferred alternative at the Site.

3) Long-Term Effectiveness

All alternatives except the no action alternative will reduce residual risk to within the acceptable risk range of 1×10^{-4} to 1×10^{-6} through treatment or containment. Alternative 6 reduces residual risk to less than 1×10^{-6} for all treated media. Incineration of contaminants and delisting of the ash will achieve clean closure; no institutional controls or other long term maintenance will be required at the Site.

Table 4

Sediment Quality Criteria (SQC) For Little Menomonee River Based on a Range and Mean Total Organic Content Found in Bottom Sediments Moss-American Site

SQC Derived From Water Quality Standards Contained in Tables 8 and 9, NR 105, and NR 102, Wis. Adm. Code

SQC#	Compound	SQC in ug/kg Based on Percent Organic Carbon in Sediment (foc)						
		1%	2%	3%	Average 3.22%	4%	5%	6%
1.	Polynuclear Aromatic Hydrocarbons (PAHs)	890	1,780	2,670	2,866	3,560	4,450	5,340
2.	Fluoranthene	12,160	24,320	36,480	39,155	48,640	60,800	72,960
3.	Ethylbenzene	110,000	220,000	330,000	354,200	440,000	550,000	660,000
4.	Chloroform	27.0	53.9	80.9	86.8	107.9	134.9	161.9
5.	Methylene Chloride	1,260	2,520	3,780	4,057	5,040	6,300	7,560
6.	Di-n-butylphthalate	1.1×10^8	2.2×10^8	3.3×10^8	3.6×10^8	4.4×10^8	5.5×10^8	6.6×10^8
7.	2,3,7,8-Tetrachloro-dibenzo-p-dioxin	0.0033	0.0066	0.0099	0.0106	0.0132	0.0165	0.0198
8.	Benzo(a)pyrene	890	1,780	2,670	2,866	3,560	4,450	5,340
9.	Acenaphthene	920	1,840	2,760	2,962	3,680	4,600	5,520

SQC Derived From "Quality Criteria For Water 1986", U.S. EPA

10.	Naphthalene*	12,400	24,800	37,200	39,928	49,600	62,000	74,400
11.	Toluene	52,500	105,000	157,500	169,050	210,000	262,500	315,000

SQC Based on U.S. EPA (1988) Interim SQC

		SQC in ug/kg Based on Percent Organic Carbon in Sediment (foc)						
		1%	2%	3%	3.22%	4%	Average 5%	6%
12.	Acenaphthene	2,622	5,244	7,866	8,442	10,488	13,110	15,732
13.	Phenanthrene	896	1,792	2,688	2,855	3,584	4,480	5,376
14.	Pyrene	13,110	26,220	39,330	42,214	52,440	65,550	78,660
15.	Benzo(a)Anthracene	13,170	26,340	39,510	42,407	52,680	65,850	79,020
16.	Fluoranthene	18,830	37,660	56,490	60,632	75,320	94,150	112,980
17.	Benzo(a)Pyrene	10,630	21,260	31,890	34,229	42,520	53,150	63,780

Alternatives 2, 3A, 3B, 4 and 5 will all reduce residual risks at the Site to 1 x 10^{-4} or less. Alternatives 3A, 3B, and 5 will be more effective in the long term than alternatives 2 and 4, as they treat the highly contaminated soil and sediment, leaving a treatment residue to be contained on-site that does not exceed health based levels. The risk from contained sediment is that the contaminants could migrate to the new channel. The migration potential is thought to be negligible, but will be addressed in the design phase of the remedial action. If the potential exists, a cohesive substance will be added to the remaining sediment to stabilize it; monitoring wells will be placed between the old and the new channel. Removal of highly contaminated sediment before re-routing the river, as in alternatives 3A and 3B, including any with free product, will reduce this potential greatly.

Failure of the soil cover in the AOC is not likely to cause increased risks to public health and the environment because 1) no contamination will be present above the 1 x 10^{-4} risk level, 2) contaminant migration to groundwater will be contained by the groundwater collection system, and 3) portions of the Site where soil will be covered will be fenced off. Alternative 4 does not provide as much long-term effectiveness as the other alternatives because none of the soil is treated except the Northeast Landfill area. It will rely on deed restrictions and fencing to prevent contact with contaminated soil.

Alternative 2, while it reduces all risks on the Site to health based levels, has the greatest long-term residual risk as no treatment is performed and it relies upon containment, fencing and deed restrictions for long-term effectiveness. The potential for contaminant movement from buried sediment will be retarded by an admixture mixed with sediment in the old channel and monitored by monitoring wells placed between the old and the new channels.

4) <u>Reduction of Toxicity, Mobility, or Volume through Treatment</u>

Alternative 6 achieves a slightly greater level of reduction in toxicity and could achieve the lowest levels of residual contamination. Incineration is designated as the Best Available Technology (BAT) for PAHs; it is anticipated that more than 99.99 percent of the contaminant mass in the treated material will be destroyed by incineration. Volume will not be significantly reduced as about 75,000 cu/yds of incinerator ash will be produced.

All the treatment alternatives will achieve significant reductions in toxicity. Alternatives 3A, 3B, and 5 will achieve greater reductions than Alternative 4, which does not treat the on-site soil. Alternative 3A and 3B treat less material than Alternative 5 and 6, but treat the more heavily-contaminated

sediment and soil and therefore treat a significant fraction of the contaminant mass. All soil and sediment treated in the slurry bioreactor and in the land treatment facility will be treated until residual risk levels are reduced to the cleanup level for CPAHs of 6.1 ppm or below the 1 x 10^{-4} risk level.

Alternative 2 will result in the least reduction in toxicity as only the small Northeast Landfill area will be treated through off-site incineration.

Groundwater treatment proposed under Alternatives 2 through 5 will reduce contaminant toxicity of contaminants in groundwater. It will reduce the target B-E-T-X compounds to the clean up standards discussed in Section 7, through removal of toxic organic compounds from groundwater by adsorption, and the destruction of these contaminants during subsequent thermal treatment of the carbon used for adsorption in the regeneration phase. Free product from the oil/water separator will also be destroyed by off-site incineration. Treatment time for Alternatives 2 and 4 will be extremely prolonged as the source will not be removed.

5) Short-Term Effectiveness

Short Term Risks to the Community: Because all the alternatives (except the No Action) involve handling contaminated sediment and/or soil, a temporary increase in risk to the community because of the potential for inhalation of windblown soil, or direct contact with contaminated sediment transported off-site is common to all. Alternative 2 involves less hazard from excavation and handling, as it does not provide for removal of contaminated sediment. The increased risk from contaminated dust could be mitigated through the use of dust suppressants, limiting earthmoving and grading activities on windy days, and downwind monitoring during construction activities. The use of the old channel as a temporary road will also limit truck traffic on city streets.

Alternatives 3A, 4 and 5 may have an organoleptic factor (odor) associated with them, but Alternatives 3B and 6 are expected to be the greatest nuisance, since land treatment (Alternative 3B) could result in odors downwind of the Site, and the incinerator (Alternative 6) could result in a steam plume, potential odors and a temporary decrease in air quality in the community.

Short Term Risks to Workers: Because worker exposure from direct contact and dust inhalation is a function of the amount of contaminated sediment and soil removed, potential for worker exposure during excavation will be high for Alternatives 3A through 6 but could be the greatest for Alternative 3B, since workers will till the contaminated soil periodically for several years. Standard protection methods, such as adequate safety

clothing and equipment will be employed to ensure no unacceptable short term risks occur.

Short Term Risks to the Environment: Short-term environmental impacts to the river and the river corridor will be significant for all alternatives involving action at the Site, since all will impact portions of existing aquatic habitats. Alternative 2, 3A, and 3B could have more adverse impact than Alternatives 4, 5, and 6 because the entire 5-mile length of stream habitat and river corridor will be involved in the construction. Restoration of these habitats is anticipated to take longer for alternatives that reroute the river than for alternatives that use the current channel. Adverse impacts on aquatic life will be limited to the Little Menomonee River by controlling resuspension of sediment and erosion to prevent migration of contaminants into the Menomonee River. It is anticipated that long-term benefits will outweigh short-term adverse effects by significantly increasing both the quality of the aquatic habitat and the recreational opportunities available in the river corridor.

An ecological assessment, including aerial photographs, is currently being performed at the Site. This assessment will be used in the design phase to develop a plan that will limit impacts to wetlands as much as possible by designating areas of least impact, suitable areas for wetland mitigation and replacement, and determining the quality of existing wetlands. If it is determined that critical habitats or endangered species exist in specified areas, then appropriate action will be taken to avoid impact to these areas, such as limiting activity on the river to dredging, and/or limited removal of sediment. This plan will be implemented in the remedial action under Alternatives 2 through 6.

The ecological assessment will also include a survey of fish communities downstream from the Site that can act as a measure of remedial action success.

Time until Protection is Achieved: The time required to achieve remedial action goals for soil and sediment is not significantly different between alternatives except for Alternative 3B. Alternative 2 will require the shortest time, 1 to 2 years of remedial action construction, because pilot testing is not required and construction techniques are straightforward. Because preliminary design and design activities for Alternatives 3A and 4 will require 1 or 2 additional years, attainment of remedial action goals will require 3 or 4 years. Alternatives 3B, 5, and 6 will take the longest to achieve remedial action goals - 5 years for Alternatives 5 and 6, and 15 years for Alternative 3B.

Groundwater standards will probably be achieved during the

construction period for Alternative 6. Alternatives 3A, 3B, and 5 could achieve groundwater standards within 5 to 10 years. Protection of the river from contaminated groundwater, however, could be achieved in the first several years of the construction period for all alternatives except Alternatives 1, 2 and 4. Since there is no source removal for Alternatives 2 and 4, time to achieve the groundwater remedial action standards could be in excess of 200 years.

In summary, none of the alternatives provides significantly better short-term effectiveness than other alternatives. Each will have similar adverse short-term environmental impact, and require several years to achieve remedial action goals for soil, sediment and groundwater.

6) Implementability

Implementation will be difficult for all alternatives. The most difficult implementation aspect relates to work on the river, which is included in all alternatives except no action. Construction work on the river involves excavating a new channel, trucking contaminated sediment to the treatment site (for Alternatives 3A through 6), and restoring the wetlands and surrounding areas. Work in the river area will require careful design and planning as well as coordination with numerous agencies, including Milwaukee County, the Milwaukee Metropolitan Sewerage District, the City of Milwaukee, and the WDNR. This difficulty exists for all alternatives except the No Action Alternative, and to a lesser extent for Alternative 2 since no sediment will be removed.

Those alternatives that remove sediment to the health-based risk level of 1×10^{-4} or 388 ppm CPAHs, Alternatives 3A and 3B, will be easier to implement in the field than alternatives that clean up to background or lower, such as Alternatives 4, 5, and 6. While it is possible in theory to develop field detection methods that will allow removal of sediment contamination to lower levels, these levels require sample testing at detection limit levels or lower. Field detection methods become by necessity more delicate and difficult once there are no physical indicators of contamination such as color, sheen or smell. If there is a physical indication of contamination, its presence can be verified by mobile laboratory methods. If there are no physical indicators, laboratory verification of contamination will require that a greater number of samples be taken and sent off-site for testing. Delays could occur while the contractor waits for laboratory verification of contamination levels in order to delineate removal boundaries. This could also result in the removal of much larger volumes of sediment than anticipated, not because the sediment is contaminated but because it is too difficult to prove that it is not contaminated.

Technology Status: All alternatives use demonstrated technologies that are readily available. While treatment of sediment contaminated with PAHs in a slurry bioreactor is considered an innovative technology, the basic components of the technology are proven and have been used frequently enough to be easily designed and implemented. Biodegradation of PAHs has been practiced for years in land treatment of petroleum hydrocarbons. Slurry reactors have also been used extensively in various applications. The use of a slurry bioreactor to treat sediment is similar to the use of aerobic or anaerobic digester to treat municipal and industrial waste water. Mining process applications of slurry reactors have established appropriate procedures for the materials feeding, slurry mixing, and solid dewatering components required in a slurry bioreactor application. Slurry bioreactors have been successfully used to treat solids contaminated with PAHs at other sites; bench scale tests conducted in the Treatability Study indicate that the technology will be effective at the Moss-American Site.

7) Estimated Cost

The estimated costs for remedial actions, listed in Table 5, are order-of-magnitude estimates with an intended accuracy range of +50 percent and -30 percent for the identified alternative. The estimated cost of the selected remedial action will be further refined in the final design. Capital costs are the direct and indirect costs required to initiate and install a remedial action. Annual operation and Maintenance cost (O&M) include the annual operating cost for a remedial action incurred and paid on a yearly basis following implementation of the remedial action. Present worth analysis (PW) provides a method for evaluating and comparing costs that occur over different time periods by discounting future expenditures to the present year.

The No-Action Alternative has no cost but will provide no protection of human health and the environment. Alternative 2 has the least capital cost of the alternatives that propose remedial action, and is protective of human health and the environment as long as the cover remains intact and there is no disturbance of the covered channel. This alternative, however, is estimated to incur the highest operation and maintenance costs due to the lengthy groundwater treatment time. Long-term management will be significantly reduced or eliminated under Alternatives 3A and 3B for a moderate increase in capital cost. Alternatives 4 and 5 are estimated to have costs similar to Alternatives 3A and 3B but will not provide as much protection to human health and the environment. Alternative 4 will, like Alternative 2 require lengthy groundwater treatment. Alternative 6 provides marginal improvement in protection of human health and the environment at significantly greater cost.

Table 5
Estimated Cost of Remedial Action
Moss-American Site

Alternative	Capital Cost	Annual O&M	Total PW
1	$ 0		
2	15,000,000	130,000	18,000,000 @ 100 yrs.
3A	25,000,000	130,000	26,000,000 @ 10 yrs.
3B	22,000,000	500,000	26,000,000 @ 10 yrs.
4	17,000,000	130,000	20,000,000 @ 100 yrs.
5	23,000,000	130,000	24,000,000 @ 100 yrs.
6	89,000,000	18,000	89,000,000 @ 30 yrs.

Note: O&M = Operation and Maintenance
PW = Present Worth

8) State Acceptance.

The State of Wisconsin is in agreement with the selection of Alternative 3A for remediation of the Moss-American Site and has provided U.S. EPA with a letter of concurrence.

9) Community Acceptance.

Public response is addressed in the attached Responsiveness Summary.

9. The Selected Remedy

Based on the findings of the RI/FS, and the evaluation of the nine criteria, U.S. EPA and the State of Wisconsin have identified Alternative 3A as the selected remedial alternative for the cleanup of the contaminated soil, sediment, and groundwater at the Moss-American Site. Alternative 3A represents the best balance among the evaluation criteria and satisfies the statutory requirements for protectiveness, compliance with ARARs, cost effectiveness, and the use of permanent solutions and treatment to the maximum extent practicable.

Alternative 3A

Time to Implement:	**3 - 4 years**
Capital Cost:	**$25,000,000**
Annual O&M Cost:	**$ 130,000**
Total Present Worth Cost:	**$26,000,000**

Major components of the selected remedy are the following:

On-site soil
* Remove and treat highly contaminated AOC on-site soil;
* Dispose of treatment residue from soil and sediment back on-site, cover and revegetate;
* Remove and treat Northeast Landfill soil in treatment unit along with AOC soil and sediment, dispose of treatment residue in AOC along with AOC treatment residue and consolidated soil.

Sediment of the Little Menomonee River
* Construct a new channel for the Little Menomonee River;
* Remove and treat highly contaminated sediment from the old channel;
* Cover old channel with soil from the new channel, revegetate;
* Restore and mitigate river corridor, habitat, wetland, and woodland areas;

Groundwater
* Construction of a groundwater collection and treatment system that will function both separately and dependently with the biological treatment system.

The selected remedy provides treatment for all three contaminated media associated with the Moss-American Site. The treatment methods proposed address the principal threat at the Site as well as reduction of all site-related contaminants to health-based levels. The treatment meets the remediation goals for cleanup of the soil, sediment and groundwater outlined in the FS.

9.1 REMEDIATION GOALS AND CORRESPONDING RISK LEVELS

9.1.1 On-site Soil

The remedial goals for soil are to minimize the threats to human health and the environment from on-site contaminants via the exposure pathways of direct contact, inhalation or ingestion and to prevent further migration into the groundwater and subsequently into the river. Because no chemical-specific ARARs have been defined for CPAHs, the concentration level that correlates to the 1×10^{-4} risk level was selected as the contaminant specific goal for soil. The contaminants specific goal, 6.1 ppm CPAHs, falls within the lower concentration range required by the Treatability Variance.

To achieve these goals, 80,000 cu/yds of "highly contaminated" or target concentration soil including the Northeast Landfill area, will be excavated and treated on-site. The removal criterion of "highly contaminated" soil equates to an EO level of 1000 ppm or

greater, or the presence of tarry or oily material and/or a creosote odor. The removal of highly contaminated soil is also expected to remove all material that exceeds a risk level of 1 x 10^{-4}, which equates to 6.1 ppm CPAHs in soil. This criterion was developed with the intent of removing the contaminated soil and sediment with the greatest migration potential, that which contains free or visible product.

The biological treatment proposed will reduce the contaminants levels in all treated media not only to the range permitted under the Treatability Variance, but to the specific target cleanup concentration of 6.1 ppm CPAHs or less. The goal is to reduce all on-site contamination, including the treatment residue, to the acceptable risk level of 1 x 10^{-4} or less.

9.1.2 Sediment of the Little Menomonee River

The remedial action goals for the sediment are to minimize direct contact or ingestion of contaminants in sediment, minimize acute and chronic effects on aquatic life posed by contaminants, and to minimize migration of contaminants downstream to the Menomonee River and ultimately to the Milwaukee Area of Concern as defined by the regional draft Remedial Action Plan (RA) submitted to U.S. EPA by the WDNR.

These goals will be achieved in two ways. A new channel for the river will prevent contact with, or ingestion of, contaminated sediment by human or aquatic life. Excavation of 5,200 cu/yds of sediment in the old channel, and subsequent treatment on-site with the on-site soil, will not only prevent contact, but also migration of contaminants downstream.

The target concentrations and the volume of sediment requiring excavation is, as with the soil, determined by the human health risk. A risk level of 1 x 10^{-4} for sediment correlates to 388 ppm CPAHs. This means that CPAH levels for sediment left in place and covered will be 388 ppm or less. While this level is acceptable for humans, it may not be sufficiently protective of aquatic life and far exceeds the SCQ recently developed by the WDNR. The SCQ, set at 3.0 ppm, correlates more closely with the 1 x 10^{-6} human risk level. A new channel for the river, even though it will necessitate a temporary loss of some wetland areas, will, in the long term, be more protective of aquatic habit.

9.1.3 Groundwater

The remedial action goals for groundwater are to prevent release of contaminants through the surficial groundwater aquifer to the Little Menomonee River surface water or sediment and remove contaminants from groundwater such that concentrations do not exceed those established in ch. NR 140 of the Wis. Adm. Code.

These goals will be accomplished by physical means and treatment. A vertical geophysical barrier placed parallel to the west bank of the river will prevent groundwater contaminants from reaching the river while the remedial action is in progress.

During the treatment process, free product will be collected, removed by an oil/water separator and disposed of in an off-site incinerator. The extracted groundwater will be treated until the level of the target compounds, B-E-T-X, are less than the PAL. Groundwater quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met. If, after the ground-water operable unit has been operating for a minimum of 5 years, it becomes apparent that it is not technically or economically feasible to achieve the PAL, then a WACL may be established. The WACL that is established may not exceed the ES for that compound.

Groundwater collection and treatment will be required until it can be demonstrated that the concentration of all groundwater contaminants have been reduced to levels that do not attain or exceed applicable NR 140 standards. The period of groundwater collection and treatment is estimated to be less than 10 years. Treated water will be discharged to the metropolitan sewer if possible. Discharge levels for the Jones Island POTW require that the discharge contain less than 5% VOCs. The POTW must be in compliance with all applicable environmental regulations in order to receive the discharge. If it is impossible to discharge to the sewer at the time the remedy is implemented, treated water will be discharged to the river. Effluent limits for a river discharge set by the State of Wisconsin are:

Chemical	Daily Maximum ppm	Monthly Average Limit (lb/day)	Annual Average Limit (lb/year)
Ethylbenzene	45	200	--
2,3,7,8-TCDD	--	1.9 x 10-9	6.9 x 10-7
Chloroform	29	1.6	--
Total CPAHs	--	1.9 x 10-3	0.68

9.2 Individual Components of the Proposed Remedial Action

9.2.1 Treatment: The bioslurry treatment is a two part process. The soil will be screened to remove oversized debris. Next, the soil is washed in an attrition scrubber and separated from the rest of the material in the screw classifier. The washed soil that meets clean up levels will be placed back on-site. Oversized material will be treated according to Best Management Practices and disposed of on-site in the RCRA compliant unit. The volume of this material is estimated at 500 - 3000 cu/yds. The remaining soil will be pumped to the slurry bioreactor along with the sediment for treatment.

Slurry bioreactors treat contaminated soil by slurrying it, then mixing the soil slurry with microorganisms in an aerated reactor. Nutrients can be added to enhance degradation. Following degradation in treatment tanks, the slurry will be dewatered before replacement on-site, while the liquid phase will be recycled. Dewatered soil and sediment (treatment residue) meeting cleanup levels will be covered on-site along with the remaining soil. Treatment residue not meeting cleanup levels will be retreated.

Treatment residue generated from the slurry bioreactor, and contaminated soil exceeding the 10^{-6} target concentrations will be contained on-site and covered with 2 feet of soil and 6 inches of topsoil. This will include treatment residue generated from treatment of contaminated soil from the Northeast Landfill (approximately 1,000 cu/yds).

9.2.2 Rerouting of the River: The new river channel will be constructed parallel to the existing channel. Construction of the new river bed will proceed from the railroad tracks just south of Brown Deer Road to the confluence of the Little Menomonee River and the Menomonee River downstream of the site. The river will then be diverted to the new channel. Following the diversion of the river, the old channel will be drained and highly contaminated sediment removed before backfilling the old channel. Refer to Appendix B of the FS for a discussion of possible construction techniques and approaches. The removal equipment will load the sediment into a lined truck for hauling to the site for treatment.

The proposed river realignment, illustrated in Figure 7, will require a detailed design study to assess the river hydraulics, effects on the wetland and woodland environment, and the effects on existing parkland and utilities. Consideration for enhancement of environmental quality and aesthetics will be addressed as well in the preliminary design phase. Construction of the channel will comply with ARARs and guidance provided by the WDNR.

9.2.3 Soil and Sediment Removal: Highly contaminated soil (80,000 cu/yds) and river sediment (5,200 cu/yds) will be removed and treated on-site using the slurry bioreactor technology. The removal criterion is 6.1 mg/kg of CPAHs in soil and 388 mg/kg in sediment which correlates to the risk level of 1×10^{-4} for both media. The removal criterion methodology will be further defined in the design phase of the remedial action.

9.2.4 Cover: Treatment residue generated from the slurry bioreactor, and on-site contaminated soil exceeding the 1×10^{-6} target concentrations, a total of about 210,000 cu/yds, will be contained on-site by covering it with 2 feet of soil and 6 inches of topsoil. The cover will be vegetated to reduce erosion and

improve aesthetics. To further reduce the likelihood for exposure to the contained soil and residue, deed restrictions will be placed on the site to prevent its development and the area of contained soil will be fenced. The permeable nature of the cover is intended to enhance groundwater treatment by flushing out the contaminants while preventing direct contact with the contaminated soil and sediment. While State RCRA closure requirements are applicable, an impermeable cap and/or double liner and leachate collection system will prolong the groundwater treatment indefinitely. For this reason, pursuant to CERCLA section 121(d), the Greater Risk to Health and the Environment waiver will be invoked concerning these State RCRA requirements, to provide a permeable cover over the treated material to decrease the time to meet groundwater cleanup standards.

9.2.5 Northeast Landfill Treatment: Contaminated soil in the Northeast Landfill, about 1000 cu/yds, will be removed, treated on-site, and the residue disposed of on-site in the RCRA compliant unit described above under 9.2.4.

9.2.6 Groundwater Collection and Treatment: Contaminated groundwater from the west side of the river will be collected by a series of supplemental drains that lead into an interceptor drain running parallel to the river, then flowing into a collection sump. The groundwater treatment system is illustrated in Figure 9. A vertical barrier, a synthetic geomembrane liner, will be placed along the east wall of the main drain trench to prevent discharge of contaminated materials to the river and recharge from the river to the collection trench.

9.2.7 Groundwater Monitoring: Groundwater monitoring will be conducted in the area of the contained soil. Four wells will be sampled on a quarterly basis and eight others will be sampled annually.

9.2.8 Preliminary Design Tasks: Refer to the discussion under Alternative 3A in Section 7 for a list of investigations to be performed before or during the design phase of construction.

10. Statutory Determinations

Under its legal authorities, the primary responsibility of U.S. EPA at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA, establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws

unless a statutory waiver can be justified. Pursuant to Section 121 of CERCLA, the selected remedy must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, this statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these requirements.

10.1. Protection of Human Health and the Environment

The selected remedy protects human health and the environment by combining source removal and treatment with containment and short term Site access restrictions, thus significantly reducing the risks posed by direct contact, inhalation, or ingestion of Site-related contaminants.

Highly contaminated soil and sediment will be excavated, and treated biologically to health based levels. The treatment residue and consolidated soil will be disposed of on-site in the AOC and covered to prevent contact. Sediment remaining in the old river channel after excavation will also be covered. The groundwater treatment system, oil/water separation and carbon absorption/biological treatment, will reduce the level of groundwater contamination to below health based levels which is also protective of the environment.

The remedy, when implemented will reduce all site-related risks to human health, currently estimated at 1 X 10-4 to 2 X 10-2, to health based levels and an acceptable risk range of 1 X 10-4 to 1 X 10-6. The remedy will also be protective of aquatic habitat and the river corridor by providing a clean channel for the river.

Any short term risks associated with excavation of contaminated materials can be controlled by the use of good construction practices.

10.2. Attainment of ARARs

The selected alternative will meet all Federal and State ARARs unless waived pursuant to Section 121(d)(4)(B). The major ARARs are presented below.

10.2.1. Action-specific ARARs:

Action specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. Waste on the Site is listed under RCRA as Hazardous Waste, K001 and U051.

- RCRA 42 U.S.C. Section 6901 et. seq.
Because soil, debris, and sediment containing listed hazardous waste will be extracted, treated and redeposited within the AOC or transferred from the Northeast Landfill area during the remedial action, placement and disposal will occur triggering RCRA requirements, including LDR 55 Federal Register 8758. The selected remedy will comply with standards contained in the State authorized RCRA program and in the self-implementing Federal requirements promulgated pursuant to HSWA with the following exceptions and/or modifications:

Land Disposal Restrictions (LDR) 40 CFR Part 268

For disposal of treatment residue from both the Northeast Landfill and the AOC, LDRs will be met through attainment of cleanup levels established through a Treatability Variance obtained under 40 CFR 268.44. Refer to Table 3 for specific cleanup levels.

State Minimum Design, Operational, and Closure Requirements, Wis. Adm. Code s. NR 181.44(10)(h), 181.42(8), and 181.44(13)

Since these requirements (part of the State of Wisconsin's authorized RCRA base program apply) to both new and existing landfills, they would be considered "applicable" due to the placement of treated soil and debris within the area of contamination during the remedial action. A waiver under Section 121(d)(4)(B) of CERCLA 42 U.S.C. is invoked for State requirements concerning design and operation, and closure of hazardous waste landfills, Wis. Adm. Code s. NR 181.44(10)(h), 181.42(8) and 181.44(13), respectively. The waiver is justified due to the fact that, assuming that the design requirements in the FS are met and both the cap and/or liner and leachate collection system are placed over the area of groundwater contamination, an impermeable cap and/or liner and leachate collection system will result in a Greater Risk to Health and the Environment by significantly delaying and reducing the effectiveness of the groundwater treatment and therefore reducing the remedial action's effectiveness in reducing risk. The risks posed by the consolidated materials have been minimized and the selected cover, a permeable hybrid cover, will enhance treatment of groundwater contamination by encouraging a flushing action. The State of Wisconsin concurs with the waiver.

The State RCRA requirement will be complied with.[1]

Discharge to Surface Water: Chapter 147, Wisconsin Statutes

This Statute applies to the discharge of any pollutant to the waters of the State. The selected remedy will achieve State ARARs for discharge to surface water through discharge to the POTW or the Little Menomonee River. Treatment residuals, the pure phase free product and spent carbon, will be incinerated off-site. The only requirement for discharge to the POTW is that VOC levels are below 5% and that the POTW has capacity for the volume discharged. Wisconsin effluent levels for discharge to the Little Menomonee River are:

Chemical	Daily Maximum (ppm)	Monthly Average Limit (lb/day)	Annual Average Limit (lb/year)
Ethylbenzene	45	200	--
2,3,7,8-TCDD	--	1.9 x 10-9	6.9 x 10-7
Chloroform	29	1.6	--
Total CPAHs	--	1.9 x 10-3	0.68

Air Emission Treatment Requirements (Wis. Adm. Code Chapter NR 445)

The need for air emission treatment such as vapor phase activated carbon treatment was evaluated based on requirements of NR 445 and an evaluation of public health risks. Based on the relative amounts of VOCs in the sediment and soil (only a few samples had VOC concentrations greater than a few mg/kg), emission treatment will probably not be necessary. Emissions will be reevaluated during predesign and air emission treatment will be included in the remedial alterative if necessary.

10.2.2. **Location-Specific ARARs:**
Location-specific ARARs are those requirements that relate to the geographical position of the Site.

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[1]While NR 181.44(10(c) [which prohibits the disposal of certain waste types, including K001, in landfills] is not an ARAR since it was not timely noticed and the prerequisite requirements of 121(d)(2)(c) have not been met, the WDNR Hazardous Waste Program has indicated in a letter that an exemption from this prohibition could be granted, under s. NR 181.05, for a non-Superfund site under similar circumstances, i.e., the same level of control and protection is provided and there is no increased threat to human health and the environment. The State of Wisconsin concurs with this evaluation.

Flood Plain and Wetland ARARs 40 CFR 264.18(b), Executive Order 11988 and 11990

The requirements of 40 CFR 264.18(b) and Executive Order 11988, Protection of Flood Plains, are relevant and appropriate to actions on the Site. To meet these ARARs, the treatment and containment systems will be located above the 100-year flood plain and be protected from erosion damage. Contaminated soil will be moved out of the flood plain before covering.

Executive Order 11990 (Protection of Wetlands) is an applicable requirement. The selected remedy includes significant excavation affecting wetlands adjacent to or downstream of the site. ARARs regarding these wetlands include Executive Order 11990, which requires that actions at the Site be conducted in a manner minimizing the destruction, loss, or degradation of wetlands, and NR 1.95, 115, 116, and 117 which require wetland and floodplain assessments to be made and submitted to WDNR for review.

These ARARs will be met through the preparation of an extensive ecological assessment, including aerial photographs, and a detailed design study to assess the river hydraulics, effects on the wetland and woodland environments, and the effects on existing parkland and utilities. This assessment and the design study will be used in the design phase to develop a plan that will limit adverse impacts to wetlands as much as possible by designating areas of least impact, suitable areas for wetland mitigation and replacement, and determining the quality of existing wetlands. Consideration for enhancement or environmental quality and aesthetics will be addressed as well in the preliminary design phase. This plan will be implemented as part of the remedial action.

State of Wisconsin Endangered and Threatened Species Protection Laws

Section 29.415, Wis. Stats., and ch. NR 27, Wis. Adm. Code, are State Endangered and Threatened Species protection laws which prohibit the "taking" or harming of endangered or threatened wildlife resources. These would be applicable to the remedial action, in that the poisoning of endangered or threatened species by site contaminants could be considered a "taking".

10.2.3. Chemical Specific ARARs:
Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical or physical characteristics.

Groundwater Quality Standards (Wis. Adm. Code, NR Chapter 140)

The State of Wisconsin is authorized to administer the implementation of the Federal SDWA. The State has also

promulgated ground-water quality standards in Ch. NR 140, Wis. Adm. Code, which, according to WDNR, is being consistently applied to all facilities, practices, and activities which are regulated by the WDNR and which may affect ground-water quality in the State. Chapter 160, Wis. Stats., directs the WDNR to take action to prevent the continuing release of contaminants at levels exceeding standards at the point of standards application. Groundwater quality standards established pursuant to Ch. NR 140, Wis. Adm. Code, may be PALs, ESs, and/or WACLs. PALs and ESs, contained in section NR 140.10, Wis. Adm. Code, are generally more stringent than corresponding Federal standards and, therefore, are relevant and appropriate to the Moss-American Site.

Consistent with the exemption criteria of section NR 140.28, Wis. Adm. Code, a WACL may be established if it is determined that it is not technically and economically feasible to achieve the PAL for a specific substance. Except where the background concentration of a compound exceeds the ES and consistent with the criteria in section NR 140.28(4)(B), the WACL that is established may not exceed the ES for that compound.

Groundwater quality will be evaluated in increments of 5 years to determine if the remedial action objectives have been met. If, after the groundwater operable unit has been operating for a minimum of 5 years, it becomes apparent that it is not technically or economically feasible to achieve the PAL, then a WACL may be established in compliance with the criteria in NR 140.28, Wis. Adm. Code. The WACL that is established may not exceed the ES for that compound.

The point of standards application for PALs and ESs (or WACLs) under section NR 140.22, Wis. Adm. Code, is any point beyond the property boundary or any point beyond the design management zone, whichever is closer to the waste boundary, or any point of present groundwater use. However, the NCP, 55 Federal Register 8753, provides that groundwater cleanup standards should generally be attained throughout the contaminant plume or at and beyond the edge of the waste management area when waste is left in place.

The implementation of the selected remedy at the Moss-American Site will be in compliance with Ch. NR 140, Wis. Adm. Code, in that PALs will be met unless WACLs are established pursuant to the criteria in section NR 140.28, Wis. Adm. Code, in which case the WACLs will be met. These standards will be met in accordance with the NCP, at the waste boundary or wherever groundwater is monitored.

10.2.4. To Be Considered (TBC)

In implementing the selected remedy, U.S. EPA has agreed to consider a procedure that is not an ARAR: compliance with Wisconsin Sediment Quality Criteria (SQC) as shown in Table 4.

The selected remedy will achieve Wisconsin SQC in order to fulfill the statutory mandate for protectiveness.

10.3. Cost-Effectiveness

The selected remedy is cost-effective because it provides a high degree of overall effectiveness proportional to its costs, the net present worth being $26,000,000. The estimated cost of the selected remedy is far less than the estimated cost associated with the best available technology economically achievable (BATEA) for treatment of PAHs, incineration, and yet the selected remedy assures a high degree of certainty that the remedy will be effective in the long-term due to the significant reduction of the toxicity of the wastes achieved through source removal, biological treatment and containment of the contaminants in the soil, sediment, and groundwater that constitute the principal threat at the Site.

10.4. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable.

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remedial action at the Moss-American Site. A combination of source removal with biological treatment and containment will significantly reduce the inherent hazards posed by the contaminated soil, sediment and groundwater at the Site. Residual contamination at the Site will be reduced to such levels that the impact on human health and the environment will be minimal if the containment system were to fail.

10.5. Preference for Treatment as a Principal Element

The selected remedy eliminates the principal threats at the Site through biological treatment of highly contaminated soil and sediment. Contaminated groundwater is also treated through absorption and destruction of absorbed contaminants by incineration.

11. Documentation of Significant Changes

The Proposed Plan for the Moss-American Site was released for public comment in June 1990. The Proposed Plan identified Alternative 3A, excavation and biological treatment of sediment and soil, and groundwater treatment, as the preferred alternative. U.S. EPA reviewed all written and verbal comments submitted during the public comment period and determined that the following change be made to the remedy. Since the time the Proposed Plan was released to the public, U.S. EPA Headquarters

has determined that a Minimum Technology RCRA (Federal) unit is not required for the treatment residue from the Northeast Landfill. Consequently, the treatment residue from the Northeast Landfill soil will be consolidated with the treatment residue from the AOC soil and sediment and disposed of within the AOC as described under Section 9.2. Section 9 of the ROD, which describes the preferred alternative, has been modified to reflect this change.

12. Responsiveness Summary

This Responsiveness Summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), which requires the U.S. EPA to respond to "...to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on a proposed plan for remedial action. The Responsiveness Summary addresses concerns expressed by the public, potentially responsible parties (PRPs), and governmental bodies in the comments received by U.S. EPA regarding the proposed plan for remedial action at the Moss-American site.

12.1. PUBLIC RESPONSE TO U.S. EPA'S PREFERRED REMEDY

In general there is not a high level of community interest in the Moss-American site. Despite press releases and Fact Sheet mailings, the public meeting was poorly attended by local residents. The majority of those present at the public meeting, and from whom comments were received, were potentially responsible parties (PRPs) at the site and their representatives, and vendors of potentially applicable technologies such as incineration. The incineration vendors identified themselves as "local residents" and their comments are included in the transcript for the public meeting.

Public response and concerns fall into two diametrically opposed categories. Those who live in the area or have businesses close by are generally supportive of the proposed action but some want to be assured that U.S. EPA is cleaning the site up sufficiently. Some expressed concern for the aesthetic aspects of the remedy and the environmental impacts of work on the river. When the PRP comments became public via the media, many concerned citizens called U.S. EPA to discuss the PRP allegations of "no risk at the site." Their main concern was that U.S. EPA might decide to do nothing at the site. Some mentioned the possibility of applying for a Technical Assistance Grant (TAG) to prevent this from becoming a reality.

PRP responses include those received from Kerr-McGee [through their contractor, Weston Inc., and their attorneys]; Milwaukee County; and the Chicago and North Western Railroad. The general theme of PRP comments was that the risks were greatly exaggerated and that no remedial action was warranted. At the very least they felt that U.S. EPA should continue investigating the site until in-depth answers were supplied for all unknowns identified at the site.

12.2. BACKGROUND ON COMMUNITY INVOLVEMENT

Community interest in the Moss-American site dates to 1971 when a group of young people, wading in the Little Menomonee River while

engaged in an Earth Day clean up, received chemical burns from what was later determined to be creosote contaminated sediments related to site activities. This event brought state and national attention to the site and sparked a series of contamination studies and some limited cleanup activities by State and Federal agencies. Community involvement since that time has been sporadic and no key community activists have been identified.

A significant number of comments were generated during the public comment period in response to the remedial investigation and feasibility study (RI/FS) reports and the proposed plan for remedial action at the site. The U.S. EPA has responded to these comments by combining those that are similar and addressing them collectively. These comments are divided into comments on the RI and Risk Assessment, the FS, and those specific to the proposed remedial action. The commenter has been identified for the most part, unless the comment was expressed by a number of commenters.

12.3. SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

12.3.1. Comments on the Remedial Investigation Report and Risk Assessment.

12.3.1.1. General Comments

COMMENT: Several commenters expressed concern that the RI did not characterize the nature and extent of contamination sufficiently to evaluate and select an appropriate remedial action for the site.

U.S. EPA's Response: The purpose of the RI (and FS) as stated in the National Contingency Plan (NCP) is to assess site conditions to the extent necessary to select and implement a remedy as soon as possible in order to be protective of human health and the environment. The NCP reflects a bias for action. U.S. EPA believes that, while the remedial investigation does not provide answers to all questions regarding the nature and extent of contamination, it was performed to a sufficient level of detail and was sufficiently comprehensive to determine the need for remedial action and to evaluate remedial action alternatives.

COMMENT: Some commenters were concerned that the estimated risks to public health and environment were overly conservative and therefore exaggerated. Alternatively, other commenters expressed support for the most conservative approaches to protection of public health and the environment.

U.S. EPA's Response: Risk characterization involves making a number of assumptions, many of which are conservative. Conservative assumptions result in higher estimated risk. It has

been U.S. EPA's policy to adopt conservative assumptions when matters of public health or protection of the environment are of concern, and therefore be more protective.

12.3.1.2. **Specific Comments**

COMMENT: The Risk Assessment was not developed in accordance with the relevant guidance for assessment of health risks. The exposure scenarios were unrealistic and overly conservative, do not follow U.S. EPA guidance, and significantly overstate health risks. (Kerr-McGee)

The use of maximum soil concentrations to determine an upper bound of risk is inappropriate and inherently assumes that all exposure could somehow occur based on the highest detected level in a single location. This provides inappropriately elevated risk estimates and conflicts with current U.S. EPA guidelines, which specifically recommend a reasonable maximum approach. (Kerr-McGee)

Incidental soil ingestion represents the major pathway of exposure to soils and sediments. This pathway was not evaluated in a manner consistent with current U.S. EPA guidance. (Kerr-McGee)

A residential scenario was assumed in defining possible risks despite the fact that this property is industrial zoned and is partially located in the floodplain and wetlands making residential development exceedingly unlikely. In such circumstances, U.S. EPA's Risk Assessment Guidance for Superfund: Human Health Evaluation Manual Part A Interim Final (July, 1989) specifically states that use of a residential scenario for risk assessments for that type of property is inappropriate. (Chicago and Northwestern Railroad)

U.S EPA's Response: The Risk Assessment for the Moss-American site was in progress prior to the release of U.S. EPA's Risk Assessment Guidance For Superfund/Human Health Evaluation Manual Part A Interim Final, July 1989, OSWER (OS-230), 9285.701A Pre-Publication Copy" (RAGS), and was prepared in accordance with agency risk assessment guidance available at the time referenced in the RI.

The use of conservative assumptions with regard to uneven distribution of hazardous substances is addressed in the current U.S. EPA guidance, RAGS, in section 6.5.3 pages 6-28. The Moss-American risk assessment presents risks associated with average and maximum contaminant concentrations to account for the expected uneven distribution and the existence of areas of high concentration accessible by the public.

COMMENT: Potency factors used in the computation of carcinogenic

risk were overly conservative. U.S. EPA endorses the relative toxicity approach for assessment of carcinogenic contaminants. This method was not applied and resulted in significant overestimation of health risks. (Kerr-McGee)

U.S. EPA's Response: The relative potency approach yields more realistic estimates of risk and has a more sound biological basis. Furthermore, the relative potency approach is consistent with U.S. EPA's (1986) guidelines for the assessment of chemical mixtures when there is inadequate data to assess the mixture itself. This guidance has an expected release date of 30 September 1990. In addition, the U.S. EPA is due to release a draft Drinking Water Criteria document in the very near future which utilizes the relative potency approach and not the uniform toxicity approach.

COMMENT: PAHs were determined to be the key pollutant contributing to the risk estimates and driving the cleanup criteria. The assumption that all carcinogenic PAHs are as toxicologically potent as B[a]P represents a vast overestimate of carcinogenic risk, conflicts with current internal U.S. EPA guidance, and is inconsistent with the Records of Decision (RODs) for similar sites. (Kerr-McGee)

The EPA report (ICF 1988) also presents a revised potency factor for B[a]P, effectively lowering its potency by three to four times. (Kerr-McGee)

It should be noted that the U.S. EPA, in the Integrated Risk Information System (IRIS) network, has withdrawn the 11.5 potency estimate and does not have a currently recommended value. This is further evidence that the U.S. EPA considers 11.5 to be an overestimate. (Kerr-McGee)

U.S. EPA's Response: The only published guidance for the use of relative potency is for dioxins and furans. There is no currently adopted guidance for a relative potency approach for the PAHs.

U.S. EPA's recently proposed rule (40 CFR 141) published in the July 25, 1990 Federal Register 55 FR 143 30370-30448, which is out for public comment, lists the option of setting the MCLG for B[a]P at zero and also the option of setting the MCLGs for benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene at zero because there is sufficient data to classify all seven PAHs as Group B2, probable human carcinogens.

The same proposed rule cited above also contains proposed MCLs for the PAHs of 0.0002, 0.0001, 0.0002, 0.0002, 0.0002, 0.0003, and 0.0004 mg/l respectively. Given that the establishment of MCLs is not strictly health based but includes analytical

capability, these proposed limits may or may not be useful in determining the relative potencies of the other PAHs. Such a minute difference between the relative toxicity of the various carcinogenic PAH would not seem to warrant separate derivation of risks nor support the rationale of not using the same slope factor for B[a]P in calculating the risk for all carcinogenic PAHs found.

The ICF report published as a final report in 1987, with a proposed B[a]P potency of 6, differs from the interim final report prepared by ICF in 1988 with a proposed potency of 3. It is not widely accepted within U.S. EPA that the ICF (1988) report is the preferred approach to assessment of risk from PAHs.

As of August 20, 1990 the slope factor for B(a)P was still 11.53 as listed in IRIS and has not been withdrawn.

COMMENT: The concentration of PAHs in the lower two reaches of the Little Menomonee River were lower than U.S. EPA documented background concentrations. (Kerr-McGee)

The total PAH concentrations in the sediment samples downstream from the Moss-American site average between 10,700 to 250,000 ug/kg. However, average concentrations of total PAHs in stream reaches 4 and 5 are 18,400 and 10,700 ug/kg respectively, which are within the average range reported for background data in Appendix J of the Feasibility Study. This clearly suggests that only the first three stream reaches may contain elevated concentrations of PAHs compared to the background data. EPA guidance requires consideration of this fact, but EPA has failed to do so. (Kerr-McGee)

U.S EPA's Response: The key word here is average. While average PAH concentrations in the last two reaches are less than for the upstream reaches, data from river reconnaissance suggests that there may be pockets of highly contaminated sediment, hot spots, in these latter two reaches. The background level for carcinogenic PAHs, calculated from samples collected upstream of the site and from tributaries, was estimated at 18 ppm or 18,000 ug/kg. Sediment samples taken from the two lower reaches of the river were found to contain carcinogenic PAHs above this level. The proposed remedial action specifies that additional sampling be performed to determine what areas will require removal. Refer to Appendix J of the FS report for details of the background sediment sampling effort as well as estimates of background concentrations based on six different groupings of data.

COMMENT: Cursory review of data utilized in the calculation of risk identified numerous instances where inaccurate concentration and risk-related data were used that suggesting (sic) fundamental errors in calculated risk. (Kerr-McGee)

The original risk assessment calculated soil ingestion without taking into account certain modifying parameters, such as the fraction of soil ingestion during a typical day that would be from the contaminated source. These exposures were recalculated using the most recent U.S. EPA guidance (EPA, 1989).

Target concentrations calculated by Weston for carcinogenic PAHs in sediment indicate that remedial action in the Little Menomonee River is not warranted. (Kerr-McGee)

U.S. EPA's Response: As stated earlier, the risk assessment was performed in accordance with the guidance that was in effect at that time. The assumptions used by Weston, specifically the B(a)P potency value from ICF, have not been peer reviewed and are not in use in current guidance. The EPA believes that remedial action for the river is warranted.

COMMENT: A cleanup criteria of 100 ppm for carcinogenic PAHs (CPAH) in residential soils has been issued by the U.S. EPA at several sites. This 100 ppm level is higher than the target cleanup concentrations for soils using the revised exposure assumptions and toxicity information. This supports the contention that the revised [Weston] risk assessment is still conservative. (Kerr-McGee)

U.S. EPA's Response: The development of cleanup criteria is normally a site-specific procedure. U.S. EPA has not developed standardized cleanup criteria for PAHs, nor has it been EPA policy to base cleanup criteria for new sites on criteria used in preceding RODs. While CPAH levels of 100 ppm or greater have been applied as cleanup criteria at other sites, these were usually accompanied by caveats such as institutional controls or other limitations that reduce potential risk. These should be noted when citing cleanup levels.

COMMENT: The soil concentration referenced [in the risk assessment] were the highest detected concentrations without regard to where these concentrations were detected. Consequently, the risk assessment hypothesizes direct exposure and inhalation exposures to surface soils while using subsurface soil analytical results. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The exposure scenario assumes that subsurface soil could be excavated and replaced as surface soil. Samples not considered representative of surface conditions (or potential surface conditions) were excluded from use in the risk assessments.

COMMENT: The risk assessment performed by U.S. EPA acknowledges that no RfD's were exceeded under any of the postulated exposure situations. That fact does not appear to have been addressed in the FS evaluation of remedial alternatives.

U.S. EPA's Response: The FS focused on the principal threat at the site, the contaminants of concern, i.e., the carcinogenic PAHs. The fact that no RfD's were exceeded at the site is inconsequential to the choice of remedy.

COMMENT: Comparison of the reported data for onsite soils and sediment with the background data suggests that several of the [inorganic] contaminants selected as chemicals of concern may not be site-related (i.e. background levels were not exceeded). These contaminants should not be included in the risk assessment. (Kerr-McGee)

U.S. EPA's Response: Inorganics contributed a very small fraction to the overall risk estimates at the site.

COMMENT: [Current EPA guidance] recommend[s] considering risks from nonsite-related anthropogenic sources separately so that decision makers can more appropriately [evaluate risk]. Data available from a variety of sources throughout the United States (ATSDR, 1990) indicate that these [PAH] concentrations can be relatively high. Table 2-3 presents some typical background soil concentrations reported in the literature... and shows that for several of these carcinogenic PAHs, the upper end of the range for the site is lower than the upper end of the range listed for urban soils. (Kerr-McGee)

U.S. EPA's Response: Aside from the fact that the table presented by Weston is incomplete in that it does not list concentrations for 7 PAHs observed at the Moss-American site, it would seem that the use of values from regions that are hundreds or thousands of miles from the site is less useful than site-specific background information collected in the vicinity of the site. The results of background soil samples taken during the RI found PAH concentrations near or below the detection limit of the analyses (p. 3-4 of RI report).

The U.S. EPA recognizes the importance of defining background levels for sediments and assumed that the grouping that included samples from tributaries to the Little Menomonee River would be used in the estimation of background. The EPA also believes that additional background sampling should be performed if background levels are used as a basis for remediation. The results obtained to date are considered adequate for the purposes of the RI/FS.

COMMENT: Although some effort was taken to ensure the background samples contained high silt, several samples were taken in gravel and sandy stream segments which would not be expected to have high natural levels of PAH compounds. As a result, the results of the background sampling may underestimate the background levels in the watershed. (Kerr-McGee)

U.S. EPA's Response: Not true. The sediment samples described as being sand are samples SD05, SD07, SD08, SD09, SD10, and SD11. Except for SD05, these samples were taken from the Menomonee River and were not used in the background calculation. SD05 exhibited higher values than the samples taken upstream of Brown Deer Road and cannot be construed as lowering the estimated background levels.

COMMENT: The recreational scenario assumes that children or adults may come into contact with contaminated sediment in the Little Menomonee River...There is no evidence to support the recreational use of the Little Menomonee River, that EPA has assumed....Based on a Weston survey by a field team of the river, the exposure scenario relative to the recreational use of the river is overly conservative. At a time of year that it might be expected for local residents to make recreational use of the river, no evidence could be found, even at the road bridge crossings, that would support a scenario for ingestion of 0.1 g/day of sediment for 40 days/year for 10 years. The vegetation cover renders the river virtually inaccessible for much of the reach downstream of the site to the Menomonee River. Indeed, the bike paths laid out through the park appeared well used, but there was no evidence of casual access to the river leading from these paths through the dense vegetation. Furthermore, the acknowledged patchy nature of the PAH contamination and the absence of obvious releases of odor of supposed deposits, bring into question the acute exposure to PAHs assumed by the risk scenarios relating to the river. (Kerr-McGee)

U.S. EPA's Response: Weston's observations totally contradict observations made by U.S. EPA staff during numerous site visits, the observations made by U.S. EPA contractors during sampling episodes conducted throughout the river over an extended period of time, and comments received from local residents regarding their perceptions of children's access to the river. A well-used foot path runs along the west side of the Little Menomonee River adjacent to the site. Numerous foot paths lead from the roads and bike path to the river in the downstream stretches. Taking into account first hand observations and comments of residents, U.S. EPA believes that assumptions regarding casual access are not overly conservative.

In addition, since the county has plans to develop the site into a usable park facility as was noted in Weston's comments, the potential for future development of the parkway to make it even more accessible is significant. The 3-day observation by the Weston field team, during a period when rainstorms occurred on two of the evenings (according to Weston's comments) in which residents could be reasonably expected to avoid recreating in the wet and muddy conditions at the site, is not considered a reasonable basis to discount the recreational use scenario.

COMMENT: The repeated references throughout the available reports to a single incident 20 years ago of skin contact leading to what is variously described as ''skin burns'' and ''skin irritations'' serve to exaggerate the significance of the potential effect. On the basis of the [Weston] field team visit, such impacts are very unlikely. (Kerr-McGee)

U.S. EPA's Response: Direct contact dermal exposure, with its potential for burns, or skin irritations, was not evaluated as a risk and was not the basis for determining the need for remedial action on the sediment. Skin irritations and burns, apparently from exposure to contaminated sediment, were documented in the past and so were referenced in the RI and FS reports; the potential for such an occurrence under the no action scenario remains a concern to the EPA.

COMMENT: The exposure assumptions used in the Risk Assessment for the Moss-American site should be modified to include:

- Recent U.S. EPA guidance (U.S. EPA, 1989) on calculating soil ingestion
- Upper 95 percent confidence intervals or some other reasonable measure of maximum exposure and not maximum soil concentrations (U.S. EPA, 1989)
- More reasonable maximum exposure assumptions, or at least appropriate documentation for the ones used.
- The use of a two-hour exposure duration for inhalation exposure when exposure is assumed for two hours.
- Consideration of carcinogenic metals inappropriately excluded. (This is more conservative than original assessment).
- Appropriate noncarcinogenic inhalation criteria.

These recommendations are all based on U.S. EPA guidance or criteria. The EPA risk assessment does not follow such guidance and criteria and must clearly be modified. Such modifications would result in a proper estimate of the ''reasonable maximum'' risk. The exposure modifications alone yield estimated risks that are significantly lower than those calculated by the EPA. Both carcinogenic and non-carcinogenic risks are between one and three orders of magnitude lower than those presented in the EPA assessment. (Kerr-McGee)

U.S. EPA's Response: Results of the revised estimates proposed by Weston do not clearly show that a revised estimate performed according to the most recent, revised guidance would estimate risk levels lower than the limits typically assumed to be the

minimum acceptable risk (i.e., the range of carcinogenic risk is 1 x 10^{-4} to 1 x 1 x 10^{-6}, with 1 x 10^{-6} being the point of departure used by U.S. EPA for determining remediation). The Weston Table C-3, for example, denotes a revised estimated risk level of 2.2 x 10^{-3} based upon maximum concentrations, and 4.9 x 10^{-5} based upon geometric mean concentrations. It is unclear whether the use of the 95 percent upper confidence limit average concentration was employed as Weston had recommended earlier. Moreover, a cursory comparison of revised target concentrations (Table 6-1, Weston) against the upper 95 percent confidence concentrations (Table 2-3, Weston) suggests that the upper end range values exceed the proposed 1 x 10^{-4} targets.

12.3.2 Comments on the Feasibility Study Report

12.3.2.1. **Specific Comments Related to Groundwater Remediation**

COMMENT: The RI previously concluded that there was no real aquifer so EPA must have defined the vertical component of the groundwater regime. If the Agency is uncertain as to the nature of the groundwater flow, then its RI was clearly inadequate and its proposed pump and treat systems, and associated cost analyses, can have no validity. (Chicago and Northwestern Railroad)

U.S. EPA's Response: While some degree of uncertainty exists in any assessment of the nature of groundwater flow, groundwater level measurements collected during the RI indicate that groundwater from the site is flowing to the Little Menomonee River. The objectives for remediation of groundwater are to attain ARARs for groundwater quality, and to prevent the discharge of creosote and dissolved PAHS to the Little Menomonee River. These objectives are consistent with guidance provided in CERCLA and the NCP.

The FS recognizes that the dissolved phase of the principal contaminants of concern in groundwater, i.e., PAHs, will tend to travel very slowly due to their hydrophobic nature and the low hydraulic conductivity on the site. Data gathered during the RI, however, indicates that contaminants are migrating into the Little Menomonee River, albeit at a very slow rate. Data also indicates that concentrations of several compounds present in the groundwater exceed Wisconsin Department of Natural Resources (WDNR) groundwater quality standards. Based on this information, the U.S. EPA believes action to remove contaminants, thereby aiding the rehabilitation of the aquifer and preventing migration to the river, are warranted.

COMMENT: The treatment system could require operation for tens of millions of years to achieve cleanup objectives. (Kerr-McGee)

U.S. EPA's Response: Without the removal of source material

(pure phase), the release of PAHs into the groundwater could continue for an indefinite period. Therefore, the preferred alternative provides for removal of much of the source material. The removal would be performed in conjunction with monitoring to verify the effectiveness of remediation and determine whether continued groundwater collection and treatment will be necessary. The U.S. EPA does not believe, however, that no action should be taken even if an extended period of groundwater collection were required.

COMMENT: There is inadequate data to define the area of (groundwater) contamination. The U.S. EPA should provide a more detailed and more comprehensive study of groundwater contamination or explain how the nine point remedial alternative screening would be affected by variation in volume of contaminated groundwater.

The major remedial action goal of the proposed cleanup at the Moss-American site is to prevent the transport of contaminants to the Little Menomonee River. The present review has identified the following reasons why the proposed cleanup will not achieve the stated goal:

- The extent of groundwater contamination has not been defined.
- The contaminants at the Moss-American site sorb to soil rather than flowing with groundwater and, therefore, will migrate much less than implied in the FS.
- The chemistry of DNAPLs assures that complete source removal is probably impossible by means of excavation.
- The strong affinity of PAHs for soil will require that the proposed groundwater collection and treatment system will require millions of years to meet cleanup objectives.

Because contaminants are nearly immobile, the potential for expansion of groundwater contamination is not significant... (and) the proposed groundwater collection system design should be rejected as unnecessary and ineffective. (Kerr-McGee)

U.S. EPA's Response: It should be noted that the "nearly immobile" contaminants at the site have, over a period of years, grossly contaminated the sediment of the Little Menomonee River, which would indicate that the "potential for expansion of groundwater contamination" is significant. The RI recognizes that the extent of groundwater contamination has not been completely defined. This definition will occur during remedial design, as will as evaluation of additional groundwater remediation measures. The nature and extent has been defined.

sufficiently to require that remedial action be performed on the groundwater, and that the remedial action plan presented in the FS report would not be altered significantly if the extent of contamination is greater than currently estimated.

The FS recognizes the strong affinity for the contaminants of concern for adsorption to soil. U.S. EPA finds no fault in its own evaluation of contaminant transport. More importantly, the Weston comment supports U.S. EPA's conclusion that, if left in place without action, the pure phase creosote will provide a long-term source of groundwater contamination and therefore should be removed.

COMMENT: The FS addresses the location of the "contaminant mass" in relation to the water table inconsistently. Page E-3 states that the large volume of the contaminant mass is below the high water table and page G-5 reiterates that conclusion. However, on page H-10, the FS concludes that much of the contamination is above the high water table. This inconsistency is significant in that the Agency uses the relationship of the water table to the contaminant mass as a basis to retain or reject remedial alternatives. For example, U.S. EPA rejects soil flushing as an option due to the location of the contaminants below the water table. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The apparent inconsistency can be clarified by restating that contaminated soil (with relatively high contaminant concentrations) exists both above and below the water table. A more quantitative assessment of the relationship between contaminant mass and water table was not performed because a qualitative assessment was adequate to evaluate the applicability of remedial technologies. Soil flushing, for example, is not considered an appropriate remedial technology for this site due to the low permeability of the saturated zone, not only because contaminant mass was found below the water table.

12.3.2.2. Specific Comments Related to Volume Estimates of Contaminated Soil and Sediment.

COMMENT: The volume of contaminated soil and groundwater may be grossly inaccurate, thereby casting the assessment of the remedial alternatives into doubt. (Kerr-McGee)

The effectiveness of the proposed cleanup plan is highly dependent upon the volume of contaminated material to be treated. There are many data gaps and irreproducible numbers in the EPA volume estimates which, if not resolved, could render proposed cleanup technologies inappropriate. (Kerr-McGee)

The shortcomings of the RI also render the relative cost analysis within the FS unsupportable since the volume of materials addressed under each remedial alternative is impossible to define

with the available information. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The degree of uncertainty in the estimated volume of soil and groundwater requiring remediation will not impact the choice of the remedial alternative as the volume of material requiring processing is only one aspect of the evaluation of remedial alternatives. If the volume of highly contaminated soil or sediment is substantially greater than estimated, the estimated cost to perform the remedy would increase, but the increased volume and associated costs should not make the proposed remedy any less effective. The cost to remediate is only one of nine criteria evaluated in the FS and is less important than the protection of human health and the environment.

Moreover, Weston's own comments do not to bear out the relationship between estimated volume and impact on effectiveness. Weston has acknowledged in the comments that an independent check on the volume calculations revealed that "To a reasonable degree of accuracy, the volume figures check, particularly if selective excavation of visibly contaminated soil is not especially efficient." This comment suggests that the volume estimates are reasonable if not conservative.

COMMENT: The proposed cleanup approach has assumed that visible PAH contamination will be removed from the river bed. No visible contamination was observed by trained Weston personnel anywhere downstream from the site during field work in July 1990 and U.S EPA laboratory data showed concentrations well below levels that would likely be visible. (Kerr-McGee)

U.S. EPA's Response: Visible contamination in the form of creosote oil was observed by experienced CH2M Hill geologists and technical field personnel (U.S. EPA's contractor) during RI fieldwork and is so noted in the field notes. The stated objective of Alternative 3A is to remove and treat the most highly contaminated soil and sediment. The FS used information as to the observed locations of visible traces of oily materials as an indication of areas that were likely to be highly contaminated.

The FS does not establish "visibly contaminated" as the cleanup criterion. The U.S EPA recognizes that the use of qualitative criteria could result in dispute between PRPs and the U.S. EPA during the RA, and has developed a quantitative criterion that will be further refined during RD. The U.S. EPA assumed in the FS that the visual measure would be employed unless such a dispute occurred. The comment provided by Weston serves to confirm the EPA's conclusion that a more quantitative measure will be necessary to verify effectiveness of remedial actions.

COMMENT: The FS also does not contain any discussion of the fact that much of CNW's portion of the property is already paved with asphalt and fenced. The fact that there is a clay barrier wall between the CNW property and the Little Menomonee River is also totally ignored in the FS. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The FS report, Chapter 1, depicts the asphalt parking lot and discusses the clay cutoff wall. These physical characteristics were not addressed in detail as they were not considered significant impediments to exposure or transport of contaminants as indicated by the fact that the contamination is currently moving off-site despite the presence of the parking lot and cutoff wall. The parking lot covers only a portion of the contaminated soil, and the clay wall is believed to span only a small fraction of the cross-sectional area of contaminated groundwater.

COMMENT: The property which CNW owns is currently zoned for industrial use and based on the location and setting of the property, it is anticipated that such use will continue. CNW itself has no intention of selling the property or significantly altering its current operations at this location. In fact, in order to eliminate any concern about potential residential development of the property, CNW is amenable to entering into institutional controls, such as deed restrictions if appropriate, to preclude development in the future. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The use of institutional controls as a means of protecting public health was considered as a potentially applicable approach in the FS. The FS reflects EPA's concern, however, that the use of institutional controls alone may be inadequate for long-term protectiveness in an area that continues to become more developed for residential use.

COMMENT: The methods of limited trench dewatering and excavation do not provide for discovery or removal of deep hot spots of free product or contaminated soil and groundwater. (A.F. Gallun and Sons Company)

U.S. EPA's Response: The U.S. EPA recognizes the need for the development of more detailed plans for soil removal, including a detailed plan for verification of attainment of remedial goals. Dewatering methods and costs assumed in the FS will be identified in greater detail during the remedial design phase.

12.3.2.3. Specific Comments Related To Wetlands Issues

COMMENT: Neither the adverse environmental impacts to flood plain and wetlands have been considered nor have the costs for mitigation and restoration been evaluated. (Kerr-McGee)
In the context of Section 404, avoiding impacts means staying out

of wetland or other waters of the United States. This will not be possible in the proposed realignment corridor area since much of the Little Menomonee flood plain appears to be wetlands. After careful review of the proposed plan to reroute the Little Menomonee River, it can be concluded that most, if not all, of the flood plain wetlands will be destroyed during construction.

Compensation for wetlands impacts usually means restoring previously converted wetlands, enhancing degraded wetland, or creating wetlands. In the FS report, minimization of construction activities in existing wetlands was noted as a means of mitigating riparian habitat destruction in the design of the new river channel. However, no discussion was given as to how the wetlands may be restored after construction. The proposed realignment does nothing towards meeting any of the conditions for compensation of wetlands impacts, namely restoring previously converted wetlands, enhancing degraded wetlands, or creating wetlands since the new alignment is apparently contained within existing wetlands. (Kerr-McGee)

The Agency has not taken into account the destruction of the existing land and aquatic plant and animal populations. Nor has the Agency taken into account the length of time required for those ecosystems to recover from such destruction, assuming that recovery is possible. (Chicago and Northwestern Railroad)

Removal of the sediments and construction of a new channel will cause widespread destruction of the natural habitat of the corridor. In addition, artificially designed channel features to restore aquatic habitats usually are difficult to establish until the channel develops some form of natural sedimentation/erosion equilibrium. Establishment of wooded vegetation will take many years further impacting the long-term value of the subject property [property of A. F. Gallun & Sons]. (A. F. Gallun & Sons)

U.S. EPA's Response: The potential for adverse impacts on wetlands was considered at great length in the FS (see Appendix B). The NCP requirement for a wetlands evaluation is not explicit regarding the level of detail for such an analysis. Guidance was provided by the WDNR as to what might be required for wetlands restoration. The conceptual design presented in the FS meets the general intent of the WDNR guidance, by providing for restoration of riparian habitat. The design would also be conducive to the development of wetlands areas alongside the pilot channel. Thus, the costs for some wetlands construction has been accounted for in the estimates. The FS also states that efforts would be made to route the river in such a manner so as to minimize the impact on existing wetlands. The preliminary analysis suggests that routing the river through areas of high quality wetlands might be avoided. The U.S. EPA realizes that the time until this constructed area becomes an established

community will mean a short-term deficit in wetlands areas, but believes that the remediated river will provide a superior habitat for aquatic life over the long-term as well as resulting in a net gain in wetlands.

COMMENT: The NCP and U.S. EPA policy on flood plains and wetlands assessments (OSWER Directive 9280.002) requires ... an environmental assessment (in the remedial planning process). In addition, the NCP and U.S. EPA policy require that a flood plain/wetlands assessment be performed and integrated into the feasibility study. Flood plain/wetlands assessments should consist of a description of the proposed action, a discussion of its effect, a description of the alternatives and their effects on the flood plain and wetland and measures to minimize potential harm to the flood plain/wetland. If the potential alternative is likely to impact a flood plain or wetland, the agency shall act to minimize adverse effects and take steps to restore and preserve the beneficial effects of flood plains/wetlands. The Moss-American Administrative Records, including the RI and FS reports, does not satisfy the NCP or current U.S. EPA policy. (Kerr-McGee)

U.S. EPA's Response: The wetlands in question were described in the RI report and the impacts to those wetlands for the various alternatives were described in the FS report. The OSWER Directive 9280.0-02 states that "flood plain/wetland assessments shall consist of a description of the proposed action, a discussion of its effect on the flood plain/wetlands, a description of the alternatives considered and their effects on the flood plains and wetlands, and measures to minimize potential harm to the flood plain/wetland if there is no practicable alternative to locating in or affecting flood plain/wetlands." While the policy directive does not identify more specific requirements for the analysis, it does identify means of minimizing possible harm to flood plains. The U.S. EPA believes that the RI and FS documents do satisfy the requirements of the NCP and current U.S. EPA policy.

The directive also recognizes that benefits such as maintenance of water quality standards, maintenance of natural systems, conservation and long-term productivity of existing flora and fauna, and other uses of wetlands, including recreational use are in the public interest. The U.S. EPA believes that the proposed alternative will produce more potentially high quality wetlands than currently exist in the Little Menomonee River corridor.

U.S. EPA, in conjunction with the WDNR and the Southeastern Wisconsin Regional Planning Commission (SEWRPC), is currently conducting an ecological study at the site that will include an analysis of the wetlands/flood plain associated with the Little Menomonee River. The wetlands will be mapped, and sensitive areas and/or areas with endangered species will be noted so that

impact can be avoided. In addition, alternative routes that would avoid or minimize effects on wetlands will be investigated.

COMMENT: The proposed river realignment cannot be justified in light of minimal risks, the problems of construction, and concerns for destruction of wetlands. (Kerr-McGee)

U.S. EPA's Response: Given that the risk assessment was performed in accordance with the U.S. EPA guidance available at the time, and that carcinogenic PAHs in sediment exceed WDNR's proposed sediment quality criteria, action on the river sediment is considered warranted.

The U.S. EPA recognized that construction of a new river channel would result in adverse short-term effects on the community. The EPA believes, however, that these impacts will be more of the nuisance variety, and of a lesser concern than the long-term risk and deleterious impact of contaminants in the sediment that probably exists. The U.S. EPA also believes that the action wherein sediments are removed without river realignment would also pose major difficulties in construction and could result in significant destruction of habitat and wetlands.

COMMENT: The FS contains no indication that U.S. Fish and Wildlife was involved in the assessment of remedial alternatives for this site. In addition, the FS does not reflect any input from the Corps of Engineers with respect to the River relocation. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The U.S. Fish and Wildlife Service, along with numerous other agencies, routinely receives for comment the draft RI and FS for each Superfund site. The Fish and Wildlife Service has concurred with the preferred remedial action at the site in a letter dated 8/22/90. The US Army Corps of Engineers will perform the remedial action if the PRPs are unwilling, or provide oversight, including design review, if the remedial action is performed by the PRPs,

12.3.2.4. Specific Comments Related to the Estimated Cost of the Proposed Remedial Action

COMMENT: Several comments relate to concerns that the cost estimate lacks sufficient detail and accuracy to provide estimates that can be used to select a remedy, and that improper assumptions or incorrect calculations may have skewed the selection of the remedy.

U.S. EPA's Response: Because the details of the remedial actions are not yet established at the feasibility study stage, the true cost of the remedy may be substantially different from the estimates presented in the Feasibility Study. The estimates, however, are not required to have a high level of accuracy since

cost is only one factor of nine to be assessed in evaluating and selecting an alternative, and has lesser significance than the two "threshold criteria." The estimates are used to compare the costs of different alternatives.

COMMENT: Access roads to the public highways will be developed as will laydown areas for equipment and materials storage. A second access may have to be constructed on the other side of the river in certain areas. Due to the wet nature of the area in which the roads will be constructed, a geonet will have to be provided under the gravel to maintain a firm base for the trucks and equipment to travel on. Clearing and grubbing in the FS estimate does not include disposal of trees and stumps. The cost estimate for clearing and grubbing needs to be revised to include stump and material disposal, grading, and erosion controls. Excavation of the new river bed is predicated in the FS on using a 1 cubic yard backhoe for the excavation. A different procedure needs to be followed employing several machines larger than a backhoe. Similarly, a 1 cubic yard backhoe selected for construction of roadway crossing transitions is too small. There will be modification work to the existing tributaries and drainage swales that is not included in this FS estimate. There are only minor allowances for dewatering. A well point system may be required until the backfilling is complete. The FS does not include costs for the disposal of gravel and geonet required for access roads. Weather problems, which can complicate the river relocation project, have not been addressed in either the original estimate or in this independent estimate. An escalation allowance for inflation has not been included. Landscaping the park area after the completion could be a major cost. (Kerr-McGee)

U.S. EPA's Response: The U.S. EPA recognizes and expects that some refinements to the cost estimates would be made in a predesign level of effort as the details for implementation of a specific design become established. Cost estimates in the FS are not intended to dictate the approach to construction. FS cost estimates are to provide relative estimates of the costs to perform the alternative remedial actions. The FS states that the expected level of accuracy for the cost estimates is "order-of-magnitude," i.e. plus 50 to minus 30 percent.

The cost estimate for the selected alternative also includes $5.5 million dollars in contingencies to address unexpected costs such as adverse impacts due to weather or dewatering costs greater than anticipated.

If the independent cost estimate prepared by Weston is compared to the U.S. EPA estimate, the cost differential is less than 20 percent if the added $1.5 million Weston assumed for dewatering and $4 million Weston assumed will be required for wetlands restoration is subtracted. At this time, there is no

information that clearly indicates that these costs will be incurred as part of this action. Only portions of the river will require sediment removal and it may be possible to remove this sediment without a well point system during dry weather since the sediment could be fed directly to the reactor as a slurry. The $4 million wetlands restoration estimate assumes that the proposed channel design will not contribute to wetlands restoration. While the intent of the channel design is to restore a riparian habitat, the U.S. EPA believes that the channel design would contribute significantly to wetlands restoration. The specific needs for wetlands restoration could not be defined during the preparation of the FS. Escalation allowances are not included in the cost estimates since cost estimates are to be prepared on a present worth basis (see Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, pg. 4-26). This type of analysis allows comparisons between the costs of alternatives, which is the intent of the cost estimate.

In conclusion, the U.S. EPA believes that the cost difference presented by Weston falls within the order-of-magnitude accuracy range expected for feasibility studies.

COMMENT: U.S. EPA has adopted a costing scheme that artificially decreases certain costs making chosen remedial alternatives appear less expensive than they realistically would be. In its cost comparisons, U.S. EPA used differing assumptions depending on the remedial alternatives being evaluated, despite the fact that the same cost parameters were being addressed in each instance. It is not substantially documented that the Health and Safety impacts of incineration are significantly different than those of bioremediation.....The health and safety costs of incineration should therefore be less than those for bioremediation since incineration requires less time on site. .... U.S. EPA's category of "other" costs which includes administration, service, and permitting costs, should also be calculated as a function of time and contamination present, rather than percentages of the remedial alternative cost....U.S. EPA has not sufficiently explained why the incineration alternative has substantially higher allowances and contingencies factored into its cost totals. (Chicago and Northwestern Railroad)

U.S. EPA's Response: Health and safety costs were estimated assuming an initial capital expense (training, decontamination pads, development of safety plans, etc.), and, then, an annual cost (e.g., for a health and safety officer). The only alternative with a longer estimated remediation period was Alternative 3B, which would not have personnel on site for extended periods, and therefore has a decreased cost for a health and safety officer. The use of percentages for "other" costs is considered an acceptable method of estimation for this level of

detail. The percentages used for bid and scope contingencies were less than and not greater than other alternatives including treatment.

COMMENT: The FS cost estimate [for the slurry bioreactor], Table I-3, makes use of CORA cost data according to the column of assumptions.... It appears, therefore, that the CORA model costs should not be used for the FS —— a higher level of accuracy is expected of an FS. (Kerr-McGee)

U.S. EPA's Response: The basis for the cost estimates shared the same assumptions recently developed for the CORA model. The reference to CORA in the FS only summarizes the fact that CORA served as the basis for assumptions related to the line item operating costs, and equipment costs. U.S. EPA recognizes that CORA should not be used when more site-specific information is available. However, because the slurry bioreactor technology has limited application history at full-scale, there is little information from which to base cost estimates. Because a superior database from which to develop estimates was not available, these same assumptions were retained and the cost tables list CORA as the source of these assumptions.

12.3.2.5. Specific Comments Related to the Proposed Treatment of Contaminated Soil and Sediment

COMMENT: Kerr-McGee concludes that the soil washing approach advocated by EPA is not feasible for application to the Moss-American site. EPA has determined that the affected soil on the site consists of approximately 50 percent fine material. But as the FS acknowledges, "study of soil washing vendors in Europe found [soil washing systems] have a practical upper limit for the fraction of fines in the soil to be treated of 20 to 30 percent." Thus ... the soil-washing technology that EPA proposes is not appropriate. (Kerr-McGee)

U.S. EPA's Response: The FS never implied that soil washing alone could be effective at remediating all of the contaminated soil on site. The proposed alternative includes bioslurry treatment to address the fines fraction of contaminated soil.

COMMENT: The conceptual model of the slurry bioreactor (FS Figure H-2) also neglects treatment of several ancillary process flows. Oversize material is rejected from treatment, yet the possibility exists that oversize materials may be heavily contaminated. Wash water from the attrition scrubber has no provision for treatment in the process schematic, yet if scrubbing is successful the water will be contaminated. The treatability study does not reflect the possible toxic effects of surfactants from the scrubber on the subsequent slurry bioreactor treatment. (Kerr-McGee)

U.S. EPA's Response: The FS report indicated that oversize material and reactor skimmings would be hauled offsite for disposal in a special waste landfill. The ROD, however, states that these materials are to be disposed of onsite in a RCRA-compliant landfill. This decision was made to limit the actions to the site boundaries.

The U.S. EPA recognizes that the treatability study data is limited and proposes to conduct a pilot-scale treatability tests to identify whether or not scrubbing will be beneficial or deleterious to the removal of PAHs from soil. Pilot studies have been reported wherein surfactant scrubbing was used prior to biological treatment without toxic shock of the organisms. This aspect of treatment feasibility would be evaluated in greater detail in a pilot study.

COMMENT: The EPA guidance [Superfund LDR Guide No. 6A] for a treatability variance to EPA's RCRA Land Disposal Restrictions shows that the bioreactor must be designed for a 99.9 percent reduction of certain PAHs, and must actually achieve 95 percent reduction. EPA seems incorrectly to have assumed in the FS that design for 95% reduction will suffice. (Kerr-McGee)

U.S. EPA's Response: The guidance cites that a 99.9 percent reduction is required only if the threshold concentration for a given restricted compound is exceeded. The guidance does not state that the design must be based on maximum observed concentrations. The FS assumes that the reduction required would be based on what is fed to the reactor, as opposed to maximum concentrations that have been observed onsite. Given that areas of highly contaminated soil are interspersed with areas of lesser contamination, the FS assumes that average concentrations of restricted compounds in the feed material to the reactor would not exceed threshold levels, and therefore a 95% design would be sufficient.

Moreover, a treatability variance is required only when the LDR treatment standard for a restricted constituent cannot be met. The treatment standards for K001 PAHs are such that a 99.9 percent reduction in the maximum observed concentrations would yield concentrations less than or approach the treatment standard. Thus, achieving a 99.9 percent removal would likely not require a treatability variance. The LDR ARAR can be met by achieving the desired percentage reduction or reducing the concentrations of the restricted constituents to 20 ppm. Although general Superfund program goals are to achieve a 90 percent reduction in the primary contaminants of concern, specific percentage reductions of carcinogenic PAHs are not required to meet ARARs.

COMMENT: The soil treatment options are assessed based on the assumption that the polynuclear aromatic (sic) hydrocarbon (PAHs)

will migrate from soils into groundwater. At the same time, the statement is made in the FS that these PAHs are not mobile, but rather adsorb on soils. That fact is used as the basis for concluding that burial of sediments in the existing stream channel is appropriate. It is clearly inconsistent to include that PAH compounds will not migrate and yet identify a preferred remedy based on migration. Similarly, it is again inconsistent to conclude PAHs will not migrate from a permeable stream channel but will through less permeable site soils. (Chicago and Northwestern Railroad)

U.S. EPA's Response: The FS acknowledges that PAHs are relatively immobile when in a dissolved phase. The FS also states that pure phase creosote could migrate at a faster rate than dissolved phase, and is controlled by phenomena that are not well understood. For these reasons, the FS suggests that removal of the pure phase may be necessary to provide more assurance that creosote will not migrate in concentrations that could yield exceedances in water quality criteria. Soil treatment options are predicated principally on the potential for exposure via direct contact and ingestion of soil, and not solely on the potential for creosote to act as a long-term source of contaminants to groundwater. Groundwater extraction and treatment may be required only for a period of time sufficient to achieve state groundwater quality criteria.

COMMENT: The slurry biotreatment that EPA has proposed may prove neither feasible nor effective and will certainly be far more costly than EPA has estimated. A residence time of 150 days would be more reasonable, would have an enormous impact, and the treatment duration could be extended several decades or 10 times as much equipment would be used. (Kerr-McGee)

U.S. EPA's Response: The basis for this concern appears to be predicated on other concerns stated by Weston:

- That the slurry bioreactor has never been proven on a full scale (Kerr-McGee);
- The treated effluent must be designed for more stringent regulatory requirements than the FS assumed;
- The degradation rate was measured by CH2M HILL to be slower than the FS assumed; and
- Numerous design needs have been overlooked including scrubber-bioreactor interaction, wash water disposal, and ancillary equipment. (Kerr-McGee)

The Weston comments suggest that, with application of proper design objectives, the slurry bioreactor would have been screened out of consideration based on implementability and effectiveness.

While slurry bioreactor technology does not have as lengthy a record of performance as some other remedial action technologies, the statement that it has never been demonstrated on full scale treatment of PAHs is incorrect. Slurry biotreatment is considered an innovative technology because it has a limited number of full-scale applications for treatment of hazardous wastes, although it employs principles and equipment that have been used in mining engineering and municipal waste water treatment. Because U.S. EPA guidance for conducting remedial investigations and feasibility studies and the NCP specify a preference for consideration of innovative technologies in cases where such technologies offer advantages (such as lower costs for similar performance and fewer adverse impacts), the slurry bioreactor was retained in the feasibility study for consideration as a treatment option.

Treatability testing was performed for the purposes of assessing whether or not the hazardous substances in soil and sediment at the Moss-American site are amenable to biodegradation. These tests were not intended, nor were they interpreted, as providing a basis for design. Moreover, the use of this data as the basis for design would be contrary to typical engineering practice in the design of this type of facility. Instead, the U.S. EPA used the results of the bench-scale testing to assess the relative biodegradability of the hazardous substances of concern, and the relative differences in degradation rates between slurry-type treatment and land-type treatment.

The bench-scale treatability testing did provide information indicating that the contaminants of concern are degradable, and the degradation rates with land treatment are significantly slower than the rates seen in slurry treatment. While the EPA recognizes the potential for difficulties with implementing innovative technologies, the NCP states a clear preference for innovative technologies. U.S. EPA believes that results from bench-scale testing is most encouraging.

Weston states that the "slurry bioreactor must be designed to achieve significantly more complete degradation of certain PAHs than EPA has recognized." The required reductions assumed in the FS differ from that assumed by Weston who, in their Table 8-1, assumed that the system would have to be designed to achieve 99.9% reductions, apparently because some samples exceeded the threshold values listed in the LDR guidance. The FS assumes that the concentration in the feed to treatment will be less than maximums since some mixing of lesser contaminated soil with the highly-contaminated sediment and soil is expected to occur. Therefore, the FS assumes that only a 95% reduction or 20 mg/kg in restricted (LDR) constituents would have to be achieved.

If a longer period of treatment is required, then costs to treat will be higher. U.S. EPA, however, does not believe that the costs could be 10 times more than estimated in the FS, as suggested by Weston. Costs for a doubling in the retention period (to 30 days), for example, would be expected to result in less than a doubling of reactor operating costs and less than a doubling of equipment capital costs due to economies of scale in operation of multiple units and due to assumptions regarding how the equipment depreciates over time. There would be no increase in other costs, such as materials handling of soil or sediment, dewatering equipment, soil washing equipment, chemicals. etc.

In summary, the expected increase in the slurry bioreactor system costs would be less than 100 percent for a doubling in the required residence time. The U.S. EPA does not consider this potential increase to be sufficient to warrant selection of an alternative remedy at this time. Before the slurry bioreactor technology would be implemented, pilot testing would be conducted to develop the actual design criteria and refine the facility costs.

COMMENT: EPA's assumption that a 15-day residence time in the bioreactor will provide sufficient degradation is completely unjustified. (Kerr-McGee)

U.S. EPA's Response: The treatability study indicated that, for PAHs whose initial concentration was at least an order of magnitude greater than the detection limit, these PAHs were reduced by 83 to 95 percent within 7 days. Four PAHs were found to have half-lives of 3 days or less. Although half-lives for several of the carcinogenic PAHs and LDR-restricted compounds were calculated to be greater than 15 days, the half-life calculation (and first order reaction decay constant) were based on concentrations observed throughout the 56 day incubation period. Examination of Table K-4 indicates that nearly all of the PAHs were reduced to concentrations approaching the detection limit after the first 7 days of the 56 day incubation period, and fluctuated around that concentration thereafter. Fluctuation near the quantification limit may have lead to overestimation of the half-lives (and underestimation of the first-order decay constant) for several of these compounds. The half-life for chrysene, for example, is reported to be 53 days even though the concentration of chrysene was reduced by 75 percent in the first 7 days. Although measurements using soil did not have this problem since initial concentrations were significantly higher, the results of the sediment testing were promising and suggested that similar results might be obtainable in the treatment of soil.

The FS notes that "The kinetic models did not apply well to the sediment flask data because the initial contaminant concentrations were rapidly reduced to levels near or below the

analytical detection limits. Degradation rates may also have been inhibited by insufficient substrate to supply enough energy for metabolic maintenance." (page K-6). Assuming similar results can be obtained with soil as were observed in sediment, the 15-day residence time does not appear unreasonable. To reiterate, the data provided in the treatability test indicate that biotreatment of sediments is promising, but such data is not suitable for design. Pilot testing to verify these assumptions is suggested in the FS and will also be included in the ROD.

12.3.2.6. Specific Comments Related to the Preferred Remedy (Alternative 3A)

Comment: No effort will be made to provide a continuous vertical hydraulic barrier and cap. This unsecured landfill will be subject to groundwater inflow and surface recharge such that further leaching and migration of contaminants could continue. The landfill will be of detrimental value to the adjoining subject property [property of A F Gallun & Sons] because of:

- Its potential to release groundwater and airborne contaminants to the environment
- Visual incompatibility
- Negative social overtones
- It must rely on continued institutional controls because of the remaining presence of carcinogens

U.S. EPA's Response: The proposed alternative for the Moss-American site will reduce all site-related contamination in the soil and sediment to the health based risk level of 1×10^{-4} or less and treat the groundwater. So, while the treatment proposed in the preferred alternative will not result in complete destruction of all contaminants, residual risk at the site will be below health based levels. The alternative also includes as part of the groundwater treatment system, a cutoff wall that will prevent off site migration of contaminants through groundwater and a collection sump for the contaminated groundwater.

As far as physical appearance is concerned, the term "landfill" is misleading. The area in which treated materials will be redeposited will not be elevated, it will be covered and revegetated and probably look very much like it does now. Because the site lies within a county park, aesthetics are of concern and will be addressed as part of the remedial design.

Issues related to health and safety during construction, e.g., control of airborne contaminants, will also be addressed more fully during the remedial design. Airborne contaminants are only of concern when the soil/sediment is disturbed, as it will be

during the remedial action. Once the remedial action is complete, airborne contaminants will not be a concern. U.S. EPA is also concerned about reliance on institutional controls over the long-term, which is one of the reasons a remedy was selected that treats the highly contaminated soil/sediments and the groundwater. The treatment minimizes the need for continued institutional controls; the control measures will be reevaluated every 5 years following implementation of the remedy and discontinued when they are no longer necessary.

COMMENTS: Several residents of the area felt they should have been notified of the proposed remediation and others expressed concerns about aspects of the proposed alternative. These concerns included rechanneling the river as opposed to maintaining the old channel, impact on business and residences, and impact on the park corridor. All residents who commented wanted the site cleaned up.

U.S. EPA's Response: Many of the concerns have been addressed in the previous portions of the Responsiveness Summary. Public notification of the on-going RI/FS included Fact Sheets and newspaper notification. The proposed plan also involved mailings and notification. In addition, the Milwaukee newspapers carried several articles about the site and site activities. U.S. EPA extended the public comment period to allow for as much comment as possible.

The agency has noted the concerns of residents and is doing as much as possible to limit impact on the river corridor and surrounding area. Work on the site will be limited by necessity to the warmer months of the year. The work will proceed one segment at a time, from the far north end to the confluence with the Menomonee River. During the time that work is in progress, the segment currently undergoing construction will not be open to the public for a period of a few months. No bridges or streets will be closed. There will probably be less disruption to the surrounding area than if road repair or construction were in progress, as work will be limited to the river area itself.

Environmental concerns were discussed in greater detail previously. An ecological assessment is now in progress that will assist us in limiting impact as much as possible. Construction work will proceed around large trees and wetland areas as much as possible.

COMMENT: Several residents wanted to go on record as being opposed to incineration as an alternative and to express their dismay that incinerator vendors were attempting to pass themselves off as residents in favor of incineration.

U.S. EPA's Response: Acknowledged.

COMMENT: Steven Skcavronek representing the Technical Advisory Committee of the Milwaukee Estuaries Remedial Action Plan explained the cleanup plan for the Milwaukee harbor and the three major rivers that empty into it. He expressed concerns with the planning process rather than the preferred alternative; the fact that cleanup levels at the site were human health based rather than environmentally based; that the cleanup did not include the Menomonee River as well as the Little Menomonee; and "lack of coordination" with the Great Lakes National Program (GLNPO) office as well as the Water Division (WD).

U.S. EPA's Response: U.S. EPA looks forward to working with the RAP group in the upcoming cleanup at the Moss-American site. In respondence to your concerns, the cleanup levels are human health based because there are no comparable numbers available for the environment. U.S. EPA and the State of Wisconsin believe that the cleanup level proposed is equally protective of the environment. The Menomonee River was not included as part of the site because background samples taken upstream in the Menomonee River and those taken below the confluence of the Little Menomonee River and the Menomonee River (downstream) have similar PAH levels. There is no present evidence to indicate that the site has contributed to the contamination already present in the river. All activities involving the Moss-American site have been coordinated with GLNPO and WD as well as many other offices. The WD has commented on the RI, the FS, and approved the proposed plan for remedial action at the site.

COMMENT: Several residents expressed appreciation and support for the remedial action.

U.S. EPA's Response: Acknowledged.

COMMENT: The County of Milwaukee is concerned about the quality of the data.

U.S. EPA's Response: Data generated by U.S. EPA and its representatives at this site has been subject to strict quality assurance/quality control procedures.

COMMENT: The County of Milwaukee expresses concerns regarding the possible location of previous dredge materials at the site.

U.S. EPA's Response: U.S. EPA will sample for existing contamination before determining the route of the river.

COMMENT: The County of Milwaukee raises the possibility of other alleged ARARs, mentioning the public interest in streams in Wisconsin, riparian rights, permitting requirements, and legislative approval.

U.S. EPA's Response: The legal issues, including riparian rights

are being investigated and will be addressed as appropriate and required by Federal law. Please note, however, that the Agency does not believe the issues raised will influence the selection of a remedial action at the site. Only promulgated State standards, requirements, criteria, or limitation under a State environmental or facility siting law, and only those identified by the State in a timely manner, are ARARs. Moreover, consistent with Section 121(d) of CERCLA, no Federal, State, or local permit shall be required for the portion of any remedial action conducted on-site. In any case, the Wisconsin statute requiring a permit for changing of stream courses does not apply to municipal or county-owned lands in counties having a population of 750,000 or more. Furthermore, U.S. EPA has obtained the consent of the State of Wisconsin to the selected remedy.

COMMENT: The County of Milwaukee suggests that it may seek compensation for the affect of the new river upon its riparian rights.

U.S. EPA's Response: U.S. EPA is acting pursuant to its powers in rerouting the river, and is increasing the value of the County's property by replacing a contaminated channel with a new channel. The question of liability or compensation is not relevant to the issue of selection of remedy.

COMMENT: The County of Milwaukee favors a delay in selection of a remedy pending review of wetland related procedures.

U.S. EPA's Response: U.S. EPA is complying with substantive State and Federal wetland related ARARs. Pursuant to Section 121(e) of CERCLA, 42 U.S.C. Section 9621(e), U.S. EPA is not required to obtain permits at the site.

COMMENT: The County of Milwaukee incorporates the comments prepared by Roy. F. Weston for Kerr-McGee.

U.S. EPA's Response: These comments have been addressed above.

COMMENT: Kerr-McGee argues that it is not a PRP.

U.S. EPA's Response: The question of liability is not relevant to the issue of selection of remedy.

12.3.2.7. Comments Received from the Wisconsin Department of Natural Resources:

U.S. EPA received a letter from the WDNR dated July 25, 1990 concerning issues related to the selection of remedy at the Moss-American site. During the development of this ROD, U.S EPA has strived to address and resolve the issues identified by the State of Wisconsin. U.S. EPA has worked closely with the State and believes it has resolved the outstanding issues as reflected in the ROD. U.S. EPA appreciates the cooperation displayed by the State of Wisconsin in coming to terms on a number of complex and difficult issues. A letter of concurrence has been received from WDNR.

ADMINISTRATIVE RECORD INDEX: UPDATE #2
MOSS-AMERICAN SUPERFUND SITE
MILWAUKEE, WISCONSIN

AR#	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	8	90/05/29	Proposed Plan for Remedial Action at the Moss-American Site Milwaukee, Wisconsin	USEPA		Fact Sheets	1
	388	90/05/24	Public Comment Feasibility Study Report Moss-American Site Milwaukee, Wisconsin	CH2M Hill	USEPA	Reports/Studies	2

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

IE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	17	89/03/28	Draft letter accompanying State Requirements for Moss American Superfund Site	C.D. Besadny State of Wisconsin	V.Adamkus - USEPA	Correspondence	1
		89/04/25	Hand written State of Wisconsin comments concerning ARARs with attachments	Angela Porter State of Wisconsin	B. Lavis - USEPA	Correspondence	2
	2	89/06/26	Letter in response to a draft memorandum describing information required to determine the classification and disposal restrictions of the waste products	Donald Johnson CH2M Hill	G.Edelstein - WDNR	Correspondence	3
	1	89/06/30	Letter requesting approval for final work plan -- revision request No. 1 (ATTACHMENT NOT INCLUDED DUE TO ITS FINANCIAL NATURE)	John Fleissner CH2M Hill	B.Lavis - USEPA	Correspondence	4
	1	89/08/29	Letter that accompanied the Moss-American Site Draft Remedial Investigation (RI) and requested the review of it and ARAR comments from April	Betty Lavis USEPA	G.Edelstein - WDNR	Correspondence	5
	1	89/09/05	Letter acknowledging the receipt of Draft Remedial Investigation	Suzanne Bengert WDNR	B.Lavis - USEPA	Correspondence	6

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			(RI) and asking for additional copies				
	8	89/11/14	Letter with high priority and specific comments on the Draft Remedial Investigation (RI)	Gary A. Edelstein George J. Kraft Suzanne Bagert WDNR	B.Lavis - USEPA	Correspondence	7
	3	89/12/28	Letter regarding the identification of sediment quality criteria for the Little Menomonee River with attachment	Steve Keith CH2M Hill	W.Wawrzyn - WDNR	Correspondence	8
	1	90/01/11	Letter acknowledging the receipt of Final Remedial Investigation Reports	Suzanne Bangert WDNR	D.Johnson - CH2M Hill	Correspondence	9
	42	90/02/06	Letter to provide a more refined identification of state standards and requirements that are Applicable or Relevant and Appropriate (ARARs) with attachments	Gary Edelstein Suzanne Bangert WDNR	B.Lavis - USEPA	Correspondence	10
	22	90/02/08	Moss American Superfund/State-EPA Meeting Agenda with sign-in sheet and various contaminant level information sheets	USEPA		Meeting Notes	11
	4	00/00/00	Comments on Draft Remedial Investigation	George J. Kraft USEPA	Moss-American File	Memorandum	12

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			(RI)				
	8	88/12/02	Hand written memo attached to listing of a literature search/review of Polycyclic Aromatic Hydrocarbons (PAH) with transmittal sheet	Hugh Allerton CH2M Hill	J.Sepesi/Phil Smith	Memorandum	13
	45	89/02/23	Memo with federal and state listing of environmental laws, regulations, criteria, advisories and guidance that may affect further remedial investigations and actions	Don Johnson CH2M Hill	A.Porter - USEPA	Memorandum	14
	8	89/04/04	Memo requesting the review of ARAR documents related to RCRA requirements for treating listed waste with attachment	Mark Giesfeldt State of Wisconsin	B.Zellner - State of WI	Memorandum	15
	2	89/04/05	Memo with additional ARAR comments -- attachment included	Don Johnston State of Wisconsin	S.Bangert - State of WI	Memorandum	16
	3	89/04/14	Memo with Review of Superfund Document, ARARs and Preliminary Identification of ARARs	Harriet Croke USEPA	F.Wrightsell - USEPA	Memorandum	17
	1	89/04/18	Memo	Diane Spencer	A.Porter - USEPA	Memorandum	18

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			with comments on a document containing preliminary alternatives and ARARs that was submitted to the Office of RCRA	USEPA RCRA/CERCLA			
		89/04/28	Memo regarding cleanup residues and the responsibilities for determining whether they are hazardous waste	Barb Zeller State of Wisconsin	Solid Waste Coordinators	Memorandum	19
	2	89/07/10	Memo with comments on QAPP Addendum #1	Gary Edelstein WDNR	B.Lavis - USEPA	Memorandum	20
	5	89/07/11	Memo with comments on the first draft of the Fund-Lead Addendum Quality Assurance Project Plan (QAPP) for Additional Sampling Activity for the Phase I Remedial Investigation with various attachments	James Adams USEPA	J.Dikinis - USEPA	Memorandum	21
	1	89/08/29	Memo requesting comments on accompanying copies of the Draft RI	Betty Lavis USEPA	Various Addressees	Memorandum	22
	3	89/09/06	Memo regarding Approval of the First Revision of the Fund-Lead Addendum Quality Assurance Project Plan (QAPP) for	Valerie Jones USEPA	N.Niedergang - USEPA	Memorandum	23

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

IE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			Additional Sampling Activity of the Phase I Remedial Investigation with original copy of sign off sheet (COPIES OF CORRECTED PAGES ARE NOT ATTACHED)				
		89/09/19	Memo regarding the review of the Remedial Investigation (RI) for the Moss-American site by RCRA for ARARs and comments about preliminary alternatives	Judy Kleiman USEPA RCRA/CERCLA	B.Lavis - USEPA	Memorandum	24
	10	89/10/12	Letter regarding comments on the Draft Remedial Investigation (RI) with attachments from RCRA, Ambient Air (AA), the Technical Support Unit (TSU) and Water Division (WD)	Betty Lavis USEPA	D.Johnson - CH2M Hill	Memorandum	25
	6	89/10/17	Memo that assigns Hazardous Waste Designations to waste and contaminated residuals at the Moss American wood preserving facilities	Barb Zeller/ Mike Metzer State of Wisconsin	M.Giesfeldt - State of WI	Memorandum	26
	1	89/10/19	Water Division Review of the Draft Remedial Investigation and Alternatives Array for the Moss-American Site	Charles H. Sutfin USEPA	B.Constantelos - USEPA	Memorandum	27

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

ME/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	3	89/10/19	Memo with comments on the review of Baseline Risk Assessment for Moss-American ARARs and Draft RI	Andrew Podowski USEPA	B.Lavis - USEPA	Memorandum	28
	2	89/11/14	Letter concerning the review of and comments on Moss-American's Draft Remedial Investigation	Will Wawrzyn State of Wisconsin	J.Schmidt - State of WI	Memorandum	29
	38	89/12/06	Memo attached to a package containing the interim "Municipal Settlement Policy" and other related documents	Don Clay USEPA	Regional Administrators	Memorandum	30
	5	90/02/09	Memo with attachments requesting approval for Work Plan Revision Request (WPRR) No. 2 (TWO PAGES HAVE BEEN REMOVED DUE THEIR CONFIDENTIAL FINANCIAL NATURE)	Betty Lavis USEPA	S.Nathan - USEPA	Memorandum	31
	29	88/04/00	Creosote Wood Preservation Facilities Recommendations for Design and Operation	D.E. Konasewich F.A. Henning Envirochem Services		Reports/Studies	32
	28	89/01/30	Final Work Plan for the Remedial Investigation Report and Feasibility Study	CH2M Hill	USEPA	Reports/Studies	33

ADMINISTRATIVE RECORD INDEX: UPDATE #1
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	115	89/08/18	Quality Assurance Project Plan Addendum No. 1 Moss-American Site Phase I Remedial Investigation	CH2M Hill	USEPA	Reports/Studies	34
	54	89/08/25	Quality Assurance Project Plan Moss-American Site RI/FS Treatability Study	CH2M Hill	USEPA	Reports/Studies	35
	114	90/01/09	Remedial Investigation Report Volume 1 Moss-American Site	CH2M Hill	USEPA	Reports/Studies	36
	454	90/01/09	Remedial Investigation Report Volume 2 Moss-American Site	CH2M Hill	USEPA	Reports/Studies	37
	95	90/01/09	Sediment Quality Criteria for Moss-American Superfund Project	Tom Janisch WDNR		Reports/Studies	38

ADMINISTRATIVE RECORD INDEX
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	2	00/00/00	Notice Letter	P.Constantelos	Kerr-McGee Chemical Corp.	Correspondence	1
	4	77/07/11	Letter re:Sludge and Soil Analysis - Milwaukee Plant	D.Martin,Environmental Sciences Division	P.Gaskin,Kerr-McGee	Correspondence	2
	10	77/09/13	Letter re:Disposal Request Kerr-McGee, transmitting Disposal request, analyses of samples from 6 different areas, and Material Safety Data Sheet	P.C.Gaskin,Kerr McGee	Nuclear Engineering Co.	Correspondence	3
	18	83/11/03	Letter re:Proposed Rule; Amendment to National Oil and Hazardous Substances Contingency Plan, National Priorities List; 48 Fed. Reg.40674 (September 8, 1983)	R.S. Hahn, Vice President Kerr Mc-Gee Chemical	R.Wyer,USEPA	Correspondence	4
	6	84/06/05	Preliminary Sampling for Creosote of the Moss-American Site	C.Crandall, Marquette University	P.Podell,Milwaukee County	Correspondence	5
	19	84/07/13	Letter transmitting final final report of the Milwaukee County Pesticide Task Force	Terry Kakida, Citizens for a Better Environment	G.Edelstein,WDNR	Correspondence	6
	5	85/04/23	Letter stating that USEPA has info. indicating that Kerr-McGee may be a responsible party, requesting information	R.Constantelos,USEPA	Kerr-McGee	Correspondence	7
	1	85/05/15	Letter stating that Kerr McGee might be willing to participate in RI/FS, but no decision will be made until discussion occurs at meeting scheduled on 5/30/85	R.Hoffman, Attorney for Kerr-McGee	J.Oaks,USEPA	Correspondence	8
	7	85/06/03	Letter re:CLRCLA 104	Kerr McGee Corporation	J.Oaks,USEPA	Correspondence	9

ADMINISTRATIVE RECORD INDEX
MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

NAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			Request				
	6	85/08/09	Letter to PRP requesting information	R.Constantelos,USEPA	Chgo Northwestern RR	Correspondence	10
	5	85/08/09	Letter to PRP requesting info.	R.Constantelos,USEPA	County of Milwaukee	Correspondence	11
	1	85/08/14	Letter stating that a meeting was scheduled between USEPA and PRP's on 8/21/85 at 1:00pm, requesting the presence of recipient	F.Rollins,USEPA	B.Hoffman,Kerr-McGe e	Correspondence	12
	2	85/08/14	Letter requesting that USEPA defer a response expected of the Milwaukee County Board until 10/1/85	G.Rice,Acting Corporation Counsel	D.Gustafson,USEPA	Correspondence	13
	1	85/08/14	Letter stating that a meeting was scheduled between USEPA and PRP's on 8/21/85 at 1:00pm, requesting the presence of recipient	F.Rollins,USEPA	G.Rice,Milwaukee County	Correspondence	14
	1	85/08/14	Letter stating that a meeting was scheduled between USEPA and PRP's on 8/21/85 at 1:00pm, requesting the presence of recipient	F.Rollins,USEPA	T.Greenland,C&NW	Correspondence	15
	7	85/08/23	Reply letters to info. requested at PRP meeting on 8/21/85, in regards to Consent Order and Statement of Work (letters to all 3 PRP's attached)	Frank Rollins,USEPA	T.Greenland,Chgo NW RR	Correspondence	16
	5	85/09/05	Letter in response to EPA's 8/7/85 letter requesting information	T.Greenland,Chicago and Northwestern Transportation Company	J.Oaks,USEPA	Correspondence	17
	1	86/04/21	Letter to Director of Milwaukee County Dept. of Parks, asking permission	R.Constantelos, USEPA	D.Schultz	Correspondence	18

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FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			to post signs on the site boundary to warn the public of the presence of hazardous wastes thereon				
7		87/01/21	Letter stating that Kerr-McGee's property lies within the proposed study area, per property description referred to in 1/19/87 letter from Kerr-McGee(attached) (site description attached)	Frank Rollins,USEPA	B.Hoffman,KerrMcGee	Correspondence	19
1		87/11/16	Letter transmitting final RI/FS Work Plan and QAPP; stating that public availability session is scheduled for 11/24/87 to discuss planned activities	Frank Rollins,USEPA	M.Giesfeldt,WDNR	Correspondence	20
2		87/11/25	Letter stating that the Site Safety Plan for Field Investigations was amended and finalized by USEPA on 11/23/87; information repository has been established; enclosing:Final Community Relations Plan,RI/FS Work Plan,QAPP,Site Safety Plan	Frank Rollins,USEPA Remedial Project Mgr	G.Rice,County Counsel	Correspondence	21
4		88/02/25	Letter transmitting Consent for Entry and Access, and a map of location in which proposed remedial investigation activities will occur	F.Rollins, USEPA	G.Rice,Milwaukee County	Correspondence	22
5		88/02/25	Letter transmitting Consent for entry and access, and a map showing location at which	F.Rollins,USEPA	T.Greenland,CANW	Correspondence	23

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MOSS-AMERICAN SITE
MILWAUKEE, WISCONSIN

FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			proposed remedial investigation activities will occur; also a narrative providing a more detailed explanation of activities planned for property owned by Chicago & NorthWestern Transportation Company				
1		88/03/08	Letter re:Moss-American Superfund Site, stating that emergency meeting of County Environmental Committee will occur on 3/17/88	George Rice, Acting Corp. Counsel, Milwaukee County	Frank Rollins, USEPA	Correspondence	24
9		88/04/13	Letter re:Moss American Site - Addendum to QAPP; stating that the extractable organics(EO) method will replace the total carbon (TC) method	Donald Johnson, CHEM Hill	Frank Rollins, USEPA	Correspondence	25
6		88/04/27	Letter transmitting copy of Consent For Entry and Access to the Chicago and North Western Property	Thomas Greenland, Chicago and Northwestern Transportation Company	Marc Radell, Asst. Reg. Coun	Correspondence	26
4		88/08/10	Letter re:Moss-American Site RI/FS, requesting additional surface water sampling	Donald Johnson, CHEM Hill, Site Manager	Angela Porter, USEPA	Correspondence	27
2		00/00/00	Fact Sheet	USEPA		Fact Sheet	28
4		87/07/00	Superfund Project Update-Fact Sheet	USEPA		Fact Sheet	29
2		88/04/00	Superfund Project Update	USEPA		Fact Sheet	30
2		85/09/23	Memo re:Moss-American Negotiations between USEPA and PRPs	D. Gustafson, Asst. Regional Counsel, and F. Rollins, Remedial Project Manager	File	Memorandum	31
2		87/12/03	Memo re:Moss American	S. Pastor, USEPA Community	File	Memorandum	32

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MOSS-AMERICAN SITE
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NME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
			Trip Report - an availability session was held 11/24/87 with residents, the press, etc.; memo details the discussions	Relations			
	1	88/04/13	Memo re:Approval of the Proposed Addendum for Substituting the Total Carbon(TC) Method with the Extractable Organics Method (EO) for Soil Screening during RI/FS activities	Andrea Jirka,USEPA	N.Niedergang,USEPA	Memorandum	33
	2	77/09/19	Illinois Environmental Protection Agency Application for Permit to Allow Disposal of Special and/or Hazardous Waste at an IEPA Permitted Disposal Site	Kerr McGee	IEPA	Permits	34
	12	78/03/03	Decision and Order United States District Court Eastern District of Wisconsin US of America,plaintiff,vs. Moss-American,Inc.,defend ant	Judge Gordon		Pleadings/Orders	35
	2	87/11/10	EPA News Release "EPA to discuss Moss-American Site"	USEPA		Press Release	36
	31	00/00/00	Statement of Work for Conducting a Remedial Investigation and Feasibility Study(RI/FS) at Moss-American Site	USEPA		Reports/Studies	37
	6	00/00/00	Site Description, Site History, Work to Be Performed	USEPA		Reports/Studies	38

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FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	38	86/11/07	Final Community Relations Plan	CH2M Hill	USEPA	Reports/Studies	39
	97	87/07/23	Final Work Plan (Revision No.1) Remedial Investigation/ Feasibility Study	CH2M Hill	USEPA	Reports/Studies	40
	[illegible]	87/10/15	Quality Assurance Project Plan - Phase I Remedial Investigation/ Feasibility Study Volume I of II	CH2M Hill	USEPA	Reports/Studies	41
	215	87/10/15	Quality Assurance Project Plan - Phase I Remedial Investigation/ Feasibility Study Volume II of II	CH2M Hill	USEPA	Reports/Studies	42
	34	87/11/12	Site Safety Plan for Field Investigations	CH2M Hill	USEPA	Reports/Studies	43

ADMINISTRATIVE RECORD SAMPLING/DATA INDEX
MOSS AMERICAN, MILWAUKEE, WISCONSIN
DOCUMENTS NOT COPIED, MAY BE REVIEWED AT THE
USEPA REGION V OFFICES, CHICAGO, ILLINOIS.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
88/05/02	Central Regional Laboratory Sample Data Report Organics/Inorganics	USEPA		Sampling/Data
88/06/09	Review of Region V CLP Data Received for Review on 6-2-88	USEPA		Sampling/Data
88/07/13	Review of Region V CLP Data Received for Review on 6-10-88	USEPA		Saampling/Data
88/07/15	Analysis Narrative	Versar General Organic Lab.		Sampling/Data
88/07/21	Review of Region V CLP Data Received for Review on 7-12-88	USEPA		Sampling/Data
88/07/21	Review of Region V CLP Data Received for Review on 7-11-88	USEPA		Sampling/Data
88/07/21	Review of Region V CLP Data Received for Review on 7-18-88	USEPA		Sampling/Data
88/07/28	Review of Region V CLP Data Received for Review on 7-27-88	USEPA		Sampling/Data
88/07/29	Analysis Narrative	Versar General Organic Lab.		Sampling/Data
88/08/01	Review of Region V CLP Data Received for Review on 7-22-88	USEPA		Sampling/Data
88/08/02	Review of Region V CLP Data Received for Review on 7-14-88	USEPA		Sampling/Data
88/08/03	Data Summaries and documentation for samples comprising SAS 3770E	Ensece, California Analytical Lab	C. Ross, USEPA	Sampling/Data
88/08/03	Review of Region V CLP Data Received for Review on 7-12-88	USEPA		Sampling/Data

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DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
88/08/05	Final Project Sample Log in Form received on 7/6/88	USEPA		Sampling/Data
88/08/09	Inorganic Analyses Data Package	USEPA		Sampling/Data
88/08/24	Review of Region V CLP Data Received for Review on 8/12/88	USEPA		Sampling/Data
88/08/25	USEPA Review of RegionV CLP Data Received for Review on 8/3/88	USEPA	CH2M Hill	Sampling/Data
88/08/26	Review of Region V CLP Data Received for Review on 8-1-88	USEPA		Sampling/Data
88/08/29	Review of Region V CLP Data Received for Review on 8-1-88	USEPA		Sampling/Data
88/09/06	Review of Region V CLP Data Received for Review on 8-11-88	USEPA		Sampling/Data
88/09/07	Review of Regoin V CLP Data Received for Review on 8-19-88	USEPA		Sampling/Data
88/09/08	Review of Region V CLP Data Received for Review on 7-28-88	USEPA		Sampling/Data
88/09/09	Review of Region V CLP Data Received for Review on 8-10-88	USEPA		Sampling/Data
88/09/12	Review of Region V CLP Data Received for Review on 9/12/88	USEPA		Sampling/Data
88/09/13	Review of Region V CLP Data Received for Review on 8-19-88	USEPA		Sampling/Data
88/09/13	Review of Region V CLP	USEPA	CH2M Hill	Sampling/Data

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MOSS AMERICAN, MILWAUKEE, WISCONSIN
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USEPA REGION V OFFICES, CHICAGO, ILLINOIS.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	Data Received for Review on 8/19/88			
88/09/14	Review of Region V CLP Data Received for Review on 8-15-88	USEPA		Sampling/Data
88/09/22	Review of Region V CLP Data Received for Review on 8/26/88	USEPA	CH2M Hill	Sampling/Data
88/09/26	Review of Region V CLP Data Received for Review on 9/20/88	USEPA	CH2M Hill	Sampling/Data
88/09/26	Review of Region V CLP Data Received for Review on 8/16/88	USEPA	CH2M Hill	Sampling/Data
88/09/27	Review of Region V CLP Data Received for Review on 8/8/88	USEPA	CH2M Hill	Sampling/Data

MOSS-AMERICAN SITE: MILWAUKEE, WI
GUIDANCE DOCUMENTS - NOT COPIED
MAY BE REVIEWED AT USEPA REGION V,
CHICAGO, ILLINOIS

TITLE	AUTHOR	DATE
Interim Guidelines and Specifications for Preparing QAPPS (QAMS-005/80)		80/12/29
Users Guide to the USEPA Contract Laboratory Program		82/08/00
MOU Between the ATSDR and	OSWER Dir.9295.1-01	82/12/00
Community Relations in Superfund: Handbook		83/09/00
State Participation in the Superfund Remedial Program,2/84		84/02/00
Community Relations Activities at Superfund Enforcement Sites		85/03/22
Guidance on Remedial Investigations and Feasibility Studies,5/85		85/05/00
Start RI/FS Tasks Under REM Contracts	OSWER Dir.9242.3-7	86/11/13
Memo:from Chief of CERCLA Enforcement New Feasibility Study Statements of Work	N.Neiderpang-USEPA	87/04/04
Final Guidance for the Cooperation of ATSDR Health Assessment Activities with the Superfund Remedial Process	OSWER Dir.9285.4-02	87/04/22
Superfund Public Health Evaluation Manual	OSWER Dir.9285.4-01	87/07/00
Interim Guidance on Compliance with Apolicable or Relevant and Appropriate Requirements 53 FR 32496 (8/27/87)	OSWER Dir.9234.0-05	87/07/09

MOSS-AMERICAN SITE: MILWAUKEE, WI
GUIDANCE DOCUMENTS - NOT COPIED
MAY BE REVIEWED AT USEPA REGION V,
CHICAGO, ILLINOIS

TITLE	AUTHOR	DATE
RI/FS Statements of Work (SOW). Memo from Chief of CES,MI/WI unit	Paul Ritter-USEPA	87/09/28
FY '88 Region V ROD Process Guidance. Memo from Chief of the Emergency & Remedial Response Branch-Waste Management Division	Mary Gade-USEPA	88/01/20